THE RHODESIA

Agricultural Journal.

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LEADING FEATURES.

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THE RHODESIA

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

The New Year.—We take this opportunity of wishing all our readers a happy and prosperous New Year. This is supposed to be the season for new resolutions, and one often hears of New Year resolutions which are made to be broken. But there is one resolution which all Rhodesian farmers should make and keep, and there is no more suitable time to make it than at each New Year. It is to lay up a store of winter feed sufficiently large to tide all the livestock on the farm over the long dry season and still have some to spare. It must be remembered that a few weeks after the rains set in there is, in most parts of the Colony, an abundance of young grass, and that young grass is excellent feed while old grass is no feed at all. The younger it is cut for hay the more digestible it is and the better feeding value it possesses. The more it is cut the longer it continues to grow and the thicker it

becomes. It is better farming practice in this country to take two or three cuttings of short young grass than one of old, and to risk the danger of having some spoilt by rain than to have all spoilt by old age.

The long dry season is natural and unavoidable. The loss of livestock from poverty in this country is unnatural and avoidable and indicates lack of foresight or bad farming.

Elsewhere we are re-printing extracts from an article published in this *Journal* more than twenty years ago by Mr. Bevan. No apology is needed for doing so, for he pointed out that winter feed is not all that is required, but that a wholesome water supply is of no lesser importance. The article extracted is just as timely now as it was when printed in April, 1915.

Minister of Agriculture visiting Ceylon.—The Hon. the Minister of Agriculture and Lands, Capt. F. E. Harris, D.S.O., is taking six weeks' holiday and intends leaving on the 5th of this month for Ceylon. The sea trip is the main object and the sailings of the boats from Durban allow only two weeks to be spent in the island. We wish the Minister a very pleasant trip and shall be glad to see him back refreshed and ready for the next Session of Parliament.

Removal of Cattle to Fresh Pasturage.—The Department of Agriculture has been advised, under letter dated 17th December, to the following effect by the General Manager, Beira and Mashonaland and Rhodesia Railways:—

"As a temporary measure, where it is necessary to transfer horned cattle from one part of the territory to another owing to lack of pasturage and/or water and no change of ownership of the animals is involved, half ordinary tariff rates (minimum £1 13s. 0d. per short truck and £3 6s. 0d. per bogie truck) will be charged in the first instance, subject to a declaration being made by the consignor, and countersigned by an official of the Government Veterinary Department, to the effect that the stock is being transferred owing to lack of pasturage and/or water."

Livestock Improvement Scheme.—The livestock improvement scheme is apparently proving of great value to the livestock farmers in this Colony. Two hundred and eighty-seven applications have been dealt with up to December 15th, of these applications 127 have been approved but in some cases the applicants have not yet been able to purchase the animals for which the grants were made.

All the funds available for the present financial year have been provisionally allotted, but it is likely that the shortage of bulls of the most popular breeds will cause a number of these provisional grants to lapse. Such released funds will then be available for applicants at present on the mailing list.

It is thought that practically all applications which have been received so far will be dealt with before March 31st next. The applicants' cases will have been investigated and, if approved, given the opportunity to purchase a sire in terms of the scheme. As a matter of fact, the shortage this year has rather been one of suitable bulls in certain breeds than one of funds.

A full report on the working of the scheme will be published in the next issue.

Co-operation in Research.—As a result of the Governors' Conference held earlier in the year, three representatives, *viz.*, the Director of Medical Services, Director of Agriculture and the Chief Veterinary Surgeon from both Northern Rhodesia and Nyasaland, visited Salisbury during the third week of December to discuss means of co-operation. This provided a most useful opportunity to obtain first-hand information on many points and a number of ways were discussed in which co-operation could be established to the mutual benefit of all the territories represented. A number of recommendations were framed which are being submitted to the three Governments, and it is confidently believed that much good has been achieved.

The New Season.—Up to the time of writing the season just opened has been a most difficult and disappointing one. The rains were very late in setting in and have been, up to Christmas, most erratic. A few farms in Mashonaland have been fortunate and the maize or tobacco crops well established, but others, perhaps only a mile or two away, have been less fortunate. Matabeleland had little rain up to the 20th of December, and the position was serious. Many tobacco growers are having the most trying season yet experienced. It was impossible to anticipate such a difficult and late planting season, and in many cases even the later planted seed-beds became completely outgrown before planting conditions arrived. It would be a difficult matter to predict what the crop returns are likely to be at the end of this season, but unless conditions remain favourable for a late season the outlook is anything but cheerful.

Dr. J. C. Hopkins at Trelawney.—Dr. Hopkins, Senior Plant Pathologist in charge of the Trelawney Tobacco Research Station, is now living on the station. A comprehensive programme of research has been arranged for the present season, and it will be a great advantage to have Dr. Hopkins actually in residence there. Although the season thus far has been difficult, all the main experimental plots are well established and valuable results may be expected. We hope that Dr. and Mrs. Hopkins will be happy in their new house and new surroundings.

Manufacturing Tobacco in India.—Carreras Ltd. (India) now have a modern tobacco manufacturing plant operating in Calcutta. The factory is equipped with Legg cutting machines capable of handling one ton per hour; with twelve cigarette machines each capable of turning out 50,000 cigarettes per hour, a total of 6,000,000 cigarettes is made each working day. All dust, dirt and other inert matter is removed by air suction before the processed leaf is run through the machines.

The various stages of manufacture are completed under controlled temperature and humidity supplied by a large air-conditioning plant, which is equipped with electrical controls for water and sprays, as is the ammonia plant for refrigeration. Constant air conditions are maintained regardless of the prevailing weather. Equable conditions are thus obtained and maintained for the factory workers, as well as for the different departments and stages of manufacture.

Tobacco Statistics.—The following table is taken from the Canadian quarterly publication called *The Lighter*, issued October 31st, 1935:

United Kingdom.—Imports of Leaf (pounds).

	January to December (12 months)		January to August (8 months)	
Countries.	1933.	1934.	1934.	1935.
Canada	13,993,219	8,058,984	6,302,137	6,170,644
Northern Rhodesia	403,393	454,634	153,275	171,877
Southern Rhodesia	10,039,593	15,880,818	7,550,435	8,488,768
Nyasaland...	10,400,436	12,521,087	7,134,864	4,301,485
Br. India	12,977,303	9,802,066	7,364,616	8,141,148
Br. North Borneo	530,148	302,759	310,905	859
Other Empire... ...	928,386	606,648	430,469	485,978
United States... ...	159,937,565	189,275,377	87,077,106	55,805,456
Other foreign... ...	2,024,151	2,356,912	1,559,373	2,380,430
Total	211,233,194	239,259,285	117,883,180	85,946,645
Total Empire	49,272,478	47,626,996	29,246,701	27,760,759
Total foreign	161,961,716	191,632,289	88,636,479	58,185,886
Empire proportion	23.3%	19.9%	24.8%	32.3%

Empire Tea.—Owing to the rapidly growing importance of the Nyasaland tea industry, the Nyasaland Tea Association will shortly become an incorporated body. At a recent meeting it was pointed out that the export of tea from the Protectorate

for the season 1935-36 would exceed 7,000,000 lbs., and that it was necessary for the industry to link with other Empire producers, which could only be done by placing the Association on a proper business footing.

To raise funds for propaganda purposes a Tea Cess Bill was recently passed by the Legislative Council, and it was left to the Nyasaland tea planters to fix the amount at 2d. per 100 lb. of tea exported.

It is intended that a Tea Growers' Association shall be formed embodying the whole of the Eastern African Dependencies—Kenya, Tanganyika, Uganda and Nyasaland—and, although Portuguese East Africa and Southern Rhodesia, where tea is also grown, are not yet included in the scheme, negotiations are going forward in order to obtain their co-operation.

Tobacco Smoke.—A very careful chemical study of tobacco is being conducted in the laboratories of the University of Sydney and financed by the Commonwealth Council for Scientific and Industrial Research. It is recognised that flavour and aroma of tobacco determines its sale value, and this type of research will be of the greatest importance to all parts of the Empire producing tobacco. The following extract refers to the investigation of tobacco smoke:—

A complete chemical analysis of a tobacco smoke would be very difficult. There are, however, certain constitutents of the smoke which have a major influence on its properties, and these are probably to be classified in two groups, namely:

(1) Substances imparting characteristic pleasant or objectionable aroma or taste; for example, various resins and essential oils, pyridine, amines, sulphur compounds, etc.

(2) Substances producing other physiological effects on the smoker, either desirable or otherwise, for example, nicotine, ammonia, carbon monoxide, methanol.

For a proper comparison of a range of tobacco in respect of their smokes, it is necessary to burn them under standard conditions. It is not easy to standardise the conditions of burning because such factors as the moisture content of the tobacco, the condensation of tar on the unburnt portions, and so on, have to be taken into account.

The present investigation was commenced by comparing the smokes produced from tobaccos which had been classified as "good" and "bad" after the usual smoking tests. The bad tobaccos gave unpleasant odours suggestive of the lower amines and also a larger amount of tar than the good tobaccos. The most clearly demonstrable difference was that the smoke from good tobaccos was slightly acid or neutral, while that from bad tobaccos was usually definitely alkaline. Measurement of the degree of alkalinity showed that, in general, the lower the tobaccos had been classified in the smoking tests, the more alkaline was the smoke they produced on burning. What was measured was, of course, the excess of alkaline over acid constituents in the smoke, and the results might be interpreted as showing a deficiency of acid or an excess of alkali. Since the alkaline substances contain nitrogen, and must be derived from the breaking down of nitrogenous constituents of the tobacco, it might be expected that a tobacco containing much nitrogen would be the most likely to give an alkaline smoke. The results obtained in the preliminary work show this to be generally the case, and it may be assumed as a working hypothesis that high nitrogen content corresponds with low quality. This will be true only if the high nitrogen content is not compensated by a high content of acidic substances as is sometimes the case in overseas tobaccos, but in the Australian samples so far examined no such compensation has been observed. The nitrogen content of a good light tobacco is about 1.0 to 1.5 per cent. (of dry solids), that of the best samples 2.0 to 2.5 per cent., and that of the very bad Australian-grown samples 3.0 to 4.5 per cent. The presence of organic acids in the leaf and the production of acids during combustion tend to control the liberation of nitrogen bases by holding them combined as salts, and it is a well-known fact that the addition of acids to a bad tobacco often improves the smoke.

SALES.

Agricultural Experiment Station, Salisbury

Spineless Cactus Slabs (blades) Algerian and Moscatel varieties, per 100 Slabs 5/- delivered at the Salisbury Experiment Station, or 7/6 delivered free by rail to any station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Kudzu Vine Crowns, per 100 Crowns 15/- delivered at Salisbury Experiment Station, or 25 Crowns 7/6; 50 Crowns 15/- and 100 Crowns 22/6, delivered free by rail to any station or siding in Southern Rhodesia. Delivery during January for dry land. Owing to pressure of other operations it is not possible to deliver Kudzu Crowns and Cactus Slabs during January and February.

Woolly Finger Grass, 10/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia; supplies limited. Available in January and February.

Swamp Couch Grass, 5/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia. Available in January and February.

The prices quoted do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Agriculturist, Department of Agriculture, Salisbcry. (Dec.-Jan.)

Native Agriculture in Nigeria.

By Dr. C. K. Brain, Director of Agriculture.

The development of native agriculture in other parts of Africa is a matter which should be of particular interest to Southern Rhodesia. We may have some idea of what is taking place in adjoining territories but news from further afield is not so readily available. The Director of Agriculture of Nigeria, G. T. Faulkner, C.M.G., gave a most interesting account of the development of native-grown crops, such as palm oil, cocoa, cotton, ground nuts, etc., in a recent copy of the *West African Review*, indicating the growth of returns from these sources during the last 25 years. In these products the exports has increased from tenfold in the case of cotton to two-hundredfold in the case of ground nuts. The most interesting feature referred to, however, is the development of mixed farming among the natives, and the following extract indicates the manner in which it has been achieved.

"The most important work of the Department, however, is one which does not yet appreciably affect the trade figures. This is the introduction of mixed farming in the Northern Provinces—that is ploughing with cattle, manure-making with the use of bedding, the keeping of cows, and the rearing of calves. Given a pair of bullocks, a family in Northern Nigeria can grow 12 to 16 acres of crop (according to the part of the country in which it is living) instead of the three to five acres that they can cultivate by hand; and, thanks to the remarkably great effect of even a little farmyard manure, and to the more frequent weeding that is possible when cattle are used, the mixed farmer gets much better crops in each of his 12 or 16 acres than he got before on each of the three or four-acre plots. In 1934 some of the mixed farmers had incomes of as much as £12 as against the £3 or so of the hand-hoe farmer. Owing to their lack of capital, every man who wishes to start has to obtain a loan of about

£5 from his Native Administration, repayable over a period of four years, to cover the cost of the bullocks and implements with which he is supplied. A start was made in 1928 with three men; by the end of 1933 the number farming on this system was 173; in 1934, 299; and in 1935 the number will be very little short of 600. Now the greater part of each of the ordinary small farms worked by hand is necessarily devoted to growing the farmer's own food. The mixed farmer needs to put no more land under food crops than does the man with the hand-hoe, for he can feed his cattle on the by-products of the farm, without growing any crops specially for cattle food. Thus each mixed farmer produces three or four times as much for export, both of ground nuts and cotton, as does his neighbour who uses only his own hands. It will be realised that when there are even a few thousand mixed farmers, not to mention a few hundreds of thousands, it will make a great difference to the exports of the Northern Provinces of Nigeria.

"There could not be a better example of the wisdom of thorough preliminary experiments than is afforded by this work. Between 1924, when the great possibilities of mixed farming were first realised, and 1928, when three ordinary farmers were asked to give the system a trial, five years was spent in working out the proposed system most fully and in making sure that it was entirely feasible and sound. Of the first three men who started, one had by the end of 1930 proved moderately successful, and one not completely unsuccessful, while one had failed completely. For three years, from 1928 to 1930, our efforts to introduce the new system had had the most discouraging results: farmer after farmer started on the new system and failed in a year or two. Had not the experiments on our own farms given us complete faith in our new system of farming there would then have seemed to be little justification for continuing our efforts to introduce it among farmers. Thanks to that confidence we could keep on, in spite of many disappointments, until we have now passed the turning point. There is now no doubt whatever that we have succeeded in starting an agricultural revolution, which in time will bring the wealth of Northern Nigeria on to an altogether different level of prosperity from that of the past."

The Control of Soil Erosion
IN THE UNION OF SOUTH AFRICA.

AN EXPLANATION OF THE VARIOUS SYSTEMS—SPECIAL FACILITIES AVAILABLE TO FARMERS UNDER THE OFFICIAL SCHEME.

In the Union the combating of the soil erosion menace, a matter which has received attention in most countries, has made tremendous progress during the past few years.

According to information obtained by the Department during 1930/31 from magistrates, special justices of the peace, native commissioners, farmers' associations and private individuals, the erosion conditions in the four provinces of the Union were more or less as set out in the accompanying table. The data comprise particulars regarding districts served by the magsitrates, special justices of the peace, or native comsioners.

Extent of Erosion in Districts.

Province or Area.	No. of districts in Province or Area.	Severe.	Advanced.	In initial stages.	Free from erosion.
Transvaal	48	8	12	22	6
Orange Free State	50	13	14	20	3
Cape Province	99	23	21	37	18
Natal	37	10	12	10	5
Native areas...	55	23	6	24	2
Total for Union ...	289	77	65	113	34

Section 17 of Act No. 29, 1933, provides for the control of soil erosion and the construction of small dams as a national concern. After the passing of the Act facilities were arranged for the combating of the menace by landowners, and the progress which has been made in this direction has fully

justified the undertaking. In order to facilitate the working of the above-named Act, it has been amended by Section 3 of Act No. 64, 1934 and Section 4 of Act No. 49, 1935.

By way of illustrating the progress which has been made and the eagerness of farmers to combat the evil, it may be pointed out that, between 25/8/33 and 2/9/35, 5,500 applications have been received, particulars of which are as follows:

Applications Received.—Scheme A: Transvaal, 500; Orange Free State, 655; Cape Province, 1,064; Natal, 89. Total, 2,363.

Scheme B: Transvaal, 266; Orange Free State, 206; Cape Province, 515; Natal, 34. Total, 1,021.

Scheme C: Transvaal, 96; Orange Free State, 207; Cape Province, 1,797; Natal, 16. Total, 2,116.

Grand total, 5,500.

To this number about 1,000 further applications should be added, bringing the total to 6,500. These 1,000 additional applications represent second and third applications submitted by applicants included in the table.

When the scheme first came into operation, the five engineers of the five schools of agriculture had to deal with all the applications, as far as preliminary surveying and the estimation of costs were concerned. The technical staff has since been increased by five engineers and thirteen assistant engineers, and in addition a soil erosion committee has been appointed in every magisterial district, the magistrate officiating as chairman. All applications should be submitted to the magistrate of the district in which the work is to be undertaken. If the nature of the work is such that technical advice is required, the application is referred to the school of agriculture concerned, where it receives the attention of an engineer or assistant engineer; if, however, the work requires no technical advice, a member of the soil erosion committee may carry out the preliminary surveying and draw up estimates.

Explanation of Schemes.—The following brief summary of the schemes may serve as a guide for those desirous of availing themselves of the facilities offered:—

SCHEME A.

At Own Expense.—Under this scheme a private owner of a farm may make application for the construction of soil erosion works and/or a small dam or dams. A bonus of 25 per cent. is payable on works previously approved and completed to the satisfaction of the Department of Agriculture and Forestry.

The bonus is payable upon completion of the works, on a certificate issued by the officer by whom the final inspection and valuation have been carried out.

The maximum bonus payable per farm is £87 10s.

A dam constructed under this scheme may not cost more than £250. All applications for the construction of dams estimated to cost more than £250 have to be referred to the Director of Irrigation for his attention.

SCHEME B.

With a Loan.—Under this scheme an amount not exceeding £350 may be borrowed for the construction of soil erosion works and/or small dams. As in the case of Scheme A, all applications for the construction of dams estimated to cost more than £250 have to be referred to the Director of Irrigation for further attention.

Provided the works are completed to the satisfaction of the Department, the loan is payable on a certificate issued by the officer by whom the final valuation has been made.

A subsidy of 25 per cent. is paid by the State, the original amount of the loan being reduced accordingly.

The loan is repayable by annual payments extending over a period of 30 years, with interest at 3½ per cent. The loan is registered as a charge against the title deeds of the property concerned. Works under Scheme B may not be commenced before the application has been approved. No loan will therefore be granted on completed or partially completed works.

No loans under Schemes B and D will be granted to an owner of an undivided share in a holding, unless all the co-owners join in the application and assume joint and several

liability for the repayment of any loan which may be granted. In other words, no loan can be granted to co-owners who have not yet taken out a partition title, unless they all apply jointly.

Advances.—Loans will only be paid out upon completion of the works and proper registration of the charge.

The Department is, however, prepared to make an advance:—

(*a*) for the buying of materials and implements. These may only be bought upon receipt of a certificate issued by the magistrate or soil erosion engineer. The accounts, which must be properly certified by the applicant, may then be forwarded to this office for payment;

(*b*) of an amount not exceeding 50 per cent. of the value of partially completed works, provided the latter have been inspected and valued by a soil erosion committee member, an engineer or an extension officer.

Advances granted under (*a*) and (*b*) may not, however, exceed 50 per cent. of the estimated value of the proposed works.

No advance will be made before the charge has been registered against the title deeds.

When submitting an application under Scheme B, the title deeds of the property on which the proposed works are to be constructed must be handed in to the magistrate simultaneously with the submission of the application.

No charge can be registered against the title deeds of undivided property unless all the co-owners join in the application and assume joint and several liability.

SCHEME C.

With European Unemployed.—Subject to the approval of the Department, an owner may be permitted to devote an amount of from £50 to £1,000 to wages for the purpose of constructing approved small dams or soil erosion work under this scheme.

A dam under this scheme must not cost more than £350 in wages.

The European unemployed must be recruited by the Department of Labour and Social Welfare.

Married labourers are paid a wage of 5s. 6d. per working day, and the owner is responsible for repayment to the State of one-eighth of the total amount of wages, over a period of 50 years, without interest. The first payment falls due five years after commencement of the works.

Upon completion of the works the amount repayable will be registered as a charge against the title deeds of the property on which the works have been constructed, unless the owner elects to pay the amount immediately.

For this purpose it is necessary that, as soon as the application is submitted, the title deeds of the property on which the works are to be constructed be shown to the magistrate for his inspection, to enable him to certify that the applicant is the registered owner.

If, however, the applicant undertakes to pay one-eighth of the estimated wage costs in cash before commencement of the works, it is unnecessary for him to hand in the title deeds.

Labourers will be recruited in two types of gangs, *viz.* :—

(*a*) Gangs of six to nine men. In this case the foreman, who must be one of the labourers and must receive a wage of 7s. per working day, may be appointed by the owner in conjunction with the magistrate and the recruiting officer.

(*b*) Gangs of ten or more labourers. In this case the Department of Agriculture and Forestry will appoint the foreman at a wage of 8s. 6d. per working day.

The applicant will be held responsible only for repayment to the State of one-eighth of 5s. 6d. of the working wage of the foreman.

Dams which will cost more than £350 in wages cannot be approved under Scheme C.

SCHEME D.

A Loan for Material, Implements and Tents.—In conjunction with Scheme C a loan not exceeding £50 is obtainable from the Department of Agriculture and Forestry for the purpose of buying material, implements, huts or tents. This loan is repayable over a period of five years, without interest, and should not be confused with a loan under Scheme B. It will also be registered as a charge against the title deeds of the applicant.

No charge under Scheme D can be registered against the title deeds of undivided property unless all the joint owners join in the application and assume joint and several liability.

SCHEME E.

Planting of Trees.—A bonus of 25 per cent. will be paid on the cost price of fencing material used for the fencing off of shrubs or trees planted for purposes of combating soil erosion. This bonus may not exceed £62 10s. The loans will be paid in two instalments, *viz.*, 12½ per cent. when the planted trees or shrubs have been fenced, and 12½ per cent. after two years if it has been proved to the satisfaction of the Department of Agriculture and Forestry that the trees or shrubs are growing and making satisfactory progress. Such planting of trees or shrubs must be approved by the Department as a soil erosion control measure before claim can be laid to a bonus.

General.—Schemes A and B may be applied on the same farm, even simultaneously, provided the works under the two schemes can be clearly distinguished. The total value of works under Scheme A plus that of works under Scheme B may not exceed £350 per farm for bonus and subsidy purposes.

Schemes A and C may be made use of on the same farm, but the works may not be constructed simultaneously. The value of the works under Scheme A plus the amount of loans paid under Scheme C may not exceed £1,000 per farm.

Under no circumstances may Schemes B and C be applied on the same farm.

Application forms and full particulars are obtainable from the local magistrate, who is chairman of the local soil erosion committee. All applications should be submitted to the magistrate.

Technical advice required for the application of the schemes will be supplied by the Department of Agriculture and Forestry free of charge.

Municipalities.— Particulars regarding the facilities under the soil erosion schemes which are placed at the sole disposal of municipalities are obtainable on application to this Department.—(Soil Erosion Section, Division of Agricultural Education and Extension, Pretoria.)

Rhodes Inyanga Estate.

The Government has lately reviewed the question of the policy to be adopted in respect of the Rhodes Inyanga Estate, and has confirmed the provisional decision taken some two years ago, to develop the property as a health and pleasure resort for the people of Southern Rhodesia, and as an attraction to tourists to the Colony.

Certain additions will be effected to the hotel, as soon as weather conditions permit, which will afford increased comfort and accommodation for visitors. Rest-camps—consisting of two sleeping huts, a dining-room hut, and a kitchen, all under brick and thatch, with native servants' quarters of pole and dagga—will be built at selected sites on the Estate, and will be equipped with a modicum or rough but essential camp furniture. It is hoped that two such camps may be completed next year, and others will be built as the demand arises.

Camping Holidays.—It is intended that these camps should be available for hire for limited periods at a reasonable charge per 24 hours, to enable parties or families desirous of spending a camping holiday at Inyanga, to take advantage of such facilities. Arrangements will be made for the supply of firewood to the camps, and a native ranger will be placed in charge of groups of camps. When the time arrives application will require to be made to the manager of the Estate for the hire of this accommodation, and such equipment as may be required.

The opening up of the Estate by means of roads, bridle paths and walks will be actively pursued. A circular road from the hotel via Inyangani Mountains and a recently constructed drift over the Pungwe River—some half-mile above the falls—has been made, and from this subsidiary roads to points of special interest or scenic beauty will gradually be developed. The circular road connects above the drift with the short route from Inyanga to Umtali. The new circular road requires much improvement, widening, draining and gravelling in places, while the grades at present in a few

places are very steep. The road is only open as yet to one-way traffic, and should not be attempted except in dry weather, and by experienced motor drivers. Improvements will be effected as soon as possible, and notice will be given as soon as the work is completed. It is anticipated that this will provide one of the most picturesque trips in the Colony, as the views from many points on the circular drive are of exquisite beauty.

Trout Fishing Next Year.—The stocking of the Estate rivers with trout will be pressed on with, and a limited stretch of water may be opened to fishing before the end of 1936.

Afforestation operations will be carried out with the objects of beautifying the property, experimenting with trees not previously grown at Inyanga and in order to enhance the commercial assets of the property. In addition, fruit experimental work will be continued, with special application to fruits of the berry class, with which Southern Rhodesia is at present inadequately supplied.

Handling and Curing Virginia Bright Tobacco.

By D. D. Brown, Chief Tobacco Officer.

The following notes dealing briefly with several of the common problems and some of the faults made in flue curing may possibly be of assistance to tobacco growers at the present time.

Many of the difficulties in the curing of tobacco may be directly traced to the field. For instance, such factors as unsuitable soil, fertilisers, field management and adverse climatic conditions all exercise some influence on the standard of curing operations.

Soil.—The use of unsuitable soil is a matter which can, in most instances, be eliminated by a more careful selection of land for the type of tobacco to be produced. The class of soil upon which it is grown largely influences the type of leaf produced; it is therefore not considered sound practice to plant tobacco on a heavy soil and endeavour to force the resulting leaf to cure a very bright colour. Exceptions to the above rule do occur, especially when virgin land is used. Under these conditions and provided seasonal conditions are favourable, general experience has proved that the first crop tends to produce a fair percentage of bright coloured leaf; the tobacco planted during the following season, however, usually produces a heavier bodied and darker coloured leaf. Any attempts made by the grower to force the second crop to cure as high a percentage of bright leaf as was secured from the first crop grown on the same land, are almost certain to result in disappointment and financial loss through a reduction in quality. The use of an excessive quantity of moisture for a prolonged period and an extended period during which the leaf is submitted to the heat of the barn are detrimental. Tobacco treated in this manner is generally neither one thing nor the other, and besides being unattractive in appearance, is also dry and brittle.

An experienced grower can usually determine by the appearance of the tobacco in the field whether the bulk of the leaf is naturally inclined to cure bright, medium or dark, and arranges his curing accordingly. Speaking generally, the lower leaves tend to cure bright, the middle leaves produce medium grades and the upper leaves cure into darks; therefore leaf harvested from different parts of the plant should not be placed in the same barn for curing.

Fertilisers.—The choice of fertiliser must of necessity be governed by the type of land used for the crop. It has been found that a complete fertiliser containing a combination of both organic and inorganic nitrogen-furnishing elements is very suitable for use on the lighter types of sandy soils, the majority of which are of granitic origin. Sandy loams and clay loams of medium fertility respond favourably to applications of complete tobacco fertilisers containing either a percentage of organic nitrogen or the total percentage of nitrogen derived from an inorganic source. On the heavier textured and more fertile soils, however, a double complete tobacco fertiliser in which all the nitrogen requirements are derived from an inorganic source is generally favoured, or special mixtures similar to the above, only that the percentage of nitrogen may be less.

Organic nitrogen forms an essential part of the fertilisers supplied, especially for dark fire cured tobacco, where the requirements are rather different from those for flue cured tobacco.

Apart from the choice of a suitable fertiliser, there is the application of adequate dressings; inadequate applications are false economy, whilst, on the other hand, excessive quantities are wasteful. Owing to the varying degrees of inherent fertility of the soil it is not possible to state the quantity of fertiliser which is to be applied. Only actual trial will enable each individual tobacco grower to determine the quantity of artificial fertiliser which will produce optimum results.

The continued application of artificial fertilisers is in itself not sufficient, and, if continued for too lengthy a period without any provision being made to maintain the humus content of the soil, will actually be detrimental.

Field Management.—Thorough preparation of the land in the first instance, followed by proper cultivation and cultural methods, will materially influence the results of the subsequent curing operations. The crop is then more likely to make continuous and more even growth, which will give greater uniformity in the leaf. A plant correctly primed and topped will ripen more uniformly and produce better tobacco than a plant which is unprimed and topped either too high or too low. The time of planting is also important; less difficulty is usually experienced in curing tobacco planted during the earlier part of the season than with the later planted portion of the crop.

Climatic Conditions.—During seasons when climatic conditions are unfavourable it is usual to expect certain difficulties in the curing of the crop. Should a prolonged dry spell occur when the tobacco is reaching maturity, the leaf turns yellow and commences to perish on the plant. This type of leaf when placed in the barn yellows well and retains a good colour until the temperature of the barn is raised approximately to 130° F.; at this stage a change in colour is often observed, the leaf turning green and curing out with a decided greenish tinge. This is due to the leaf being immature; the yellow coloration in the field is an indication of the plant perishing, though it is often mistaken as a sign of ripening. When false ripening is in evidence the harvesting is best delayed for a short while, say, a week or ten days, as very frequently a shower of rain will arrive in time to prevent the plants from dying off any further. Should the dry weather continue, or the leaves begin to deteriorate rapidly, the only course is to proceed with the reaping. The incidence of heavy or continuous rains after a dry spell will induce second growth, which makes the leaf very difficult to cure, and very often such leaf will fail to cure at all. When attempting to cure tobacco of this nature a slow rate of curing is essential until the requisite yellow coloration is obtained; care should also be taken not to rush the temperature up too fast before all the green possible has been eliminated. It is sometimes advisable to yellow the leaf first by hanging the sticks in a wilting shed before placing the tobacco in the barn. During seasons of heavy rainfall the tobacco in the field will some-

times turn yellow prematurely, though in this instance it is generally found that the curing yields more satisfactory results than is the case when drought prevails.

Every effort should be made to eliminate or reduce to a minimum the green tobacco irrespective as to whether the season be favourable or otherwise, even though this be only attained through sponging some of the leaf. Sponged tobacco retains a commercial value, whereas green tobacco is practically valueless.

Harvesting and Curing.—Leaf fully ripe and of uniform body and texture should be reaped for each barn; reasonable care exercised in this respect will materially assist in the curing operations. Damaged and inferior leaf is often harvested and used in place of better leaf which, if left on the plant too long, loses quality. The leaves to each hand should be placed back to back when tied on the stick; the number of hands should fill the stick without overcrowding. When filling the barn the tobacco sticks should be evenly spaced along each tier and overcrowding the barn avoided. The leaf is more liable to "sponge" in an over-filled barn and during wet weather "pole sweat" will occur. The amount of "sponging" can usually be controlled by opening the ventilators and slightly increasing the temperature; increased ventilation and temperature, with a reduction in the relative humidity, is also required to control "pole sweat."

Bottom ventilation must be carefully regulated when the outside atmosphere is either saturated or extremely dry; under these circumstances it is often advisable to keep the lower ventilators closed or only very slightly opened. When little or no bottom ventilation is used, it is necessary to commence ventilating at the top as soon as the temperature in the barn is 100° F. to 105° F., if the leaf shows any signs of sponging. The top vents are at first opened very little and the aperture gradually increased as the curing proceeds. The above method is useful in eliminating a certain amount of the green when a mixed barn is being cured. The timely use of top ventilation to prevent the yellow leaf from "sponging" and a minimum of bottom ventilation prevent the atmosphere of the barn from drying too rapidly, thus leaving the greener tobacco more opportunity for "yellowing."

Under normal conditions the tobacco grower should use his standard methods and formulæ which personal experience has proved to yield the most satisfactory results in curing the crop.

The provision of warm air ducts leading into the barn will also enable the grower to cure his leaf to better advantage. This system is recommended in place of the present practice wherein cold air is commonly introduced into the barn.

An excessive quantity of water thrown on to the floor will induce "sponging," particularly in the case of earth floors. It has often been observed that a thoroughly saturated earthen floor causes difficulty in reducing the relative humidity when the temperature has reached 130° F. approximately. At this temperature a great deal of moisture is driven out of the floor; hence the increased humidity within the barn, even though the same barn appeared to have the correct degree of relative humidity at, say, 120° F. to 125° F. Brick floors should be provided with a thin coating of cement for preference, as it is then easier to control the humidity, especially if drain plugs are let in through the walls to run off surplus water when it is no longer required in the barn.

As the curing season progresses the rate of curing gradually becomes slower, the leaf takes longer in colouring and fixing the colour. A great deal of damage to the tobacco is incurred through raising the maximum temperature too high during the final stages of curing. A maximum temperature in excess of 160° F. should not be permitted, as higher temperatures will rapidly cause the leaf to deteriorate, rendering it dry and brittle, besides scorching it to some extent.

After the tobacco is cured it is a common practice to bale the leaf immediately after it is removed from the barn and has been "conditioned," the reason usually advanced for this procedure being lack of storage room. Whilst tobacco in bales might possibly require less floor space for storage, the saving in space is not always so great as is imagined; in fact, the reverse is often the case. The practice of baling before grading is to be deprecated, as this method entails a deal of wastage, besides rendering subsequent

grading more difficult owing to the tobacco having been tightly pressed and the leaves in consequence being hard to separate. Another disadvantage is also apparent when the tobacco has been baled too dry to improve in colour and aroma.

When "bulked" the tobacco can be "conditioned" to a correct degree which fulfils the requirements of the type of leaf, and if properly handled the tobacco will improve more rapidly. There is also less cause for wastage and the tobacco is more easily examined in the bulks than when in bales. If the tobacco is roughly graded into brights, mediums, darks and greens prior to being "bulked," much time will be saved in the final grading, and bulks containing only one class of leaf can be handled to better advantage. The bright bulks would naturally be those first chosen for final grading and baling, followed by the mediums, darks and greens in the order stated. When only one class of tobacco at a time is being handled, less difficulty in grading is experienced by unskilled native graders.

Steam, superheated or used in excess, is also liable to reduce the quality and value of the leaf.

In conclusion, it is not suggested that the above notes deal completely with the subject under review, and reference therefore should be made to previous articles on tobacco culture published in the *Rhodesia Agricultural Journal*, from which reprints are available in bulletin form.

Locusts and a Rational Anti-Locust Policy.

By B. P. Uvarov, Imperial Institute of Entomology.

(Reprinted from *The Empire Cotton Growing Review*, July, 1935.)

The layman's conception of locusts is that of insects which suddenly appear from somewhere in enormous swarms darkening the sky, and disappear again leaving bare ground in place of rich pasture and abundant crops. The mysterious origin of the swarms, their enormous size and the countless numbers of individuals of which a swarm is composed, all create an impression of utter impossibility of ever defeating this pest. It is exactly this spirit of hopelessness which is typical of the anti-locust policy over practically the whole world. In the great majority of countries subject to periodical locust ravages nothing is ever undertaken to prevent the appearance of swarms, and no attention is paid to locusts until the invasion reaches such an extent that the battle against it can be counted as lost before it begins. The organisation for defence is designed only to save the crops and to minimise the losses. Enormous sums of money are spent on such defensive measures, and not always with success. In the Argentine, for example, the amount spent on locust control during the period 1897-1933 totalled over £11,000,000. This means that more than £300,000 on an average were spent every year, and in some years the expenditure rose to nearly a million pounds. In the Union of South Africa £1,125,000 were spent on locust control during the years 1920 to 1928, or £125,000 annually, and in the year 1934 alone the cost was £1,400,000. To these expenses must be added the cost of tens of millions of working days spent in fighting locusts by the population, who are obliged to do so by law. It should be clear that the economic aspect of the locust problem is a very serious one.

An objection can be made that locusts are not a universal pest, but occur only in some countries. As a matter of fact, however, on every continent there are only a few countries which are safe from these pests. In most of Europe, it is true, no locust swarms have occurred for nearly a century, but the Mediterranean countries are still suffering from them regularly, and a heavy outbreak is developing in Southern Spain at the moment. On the south-eastern fringe of Europe, in the steppes of Russia and the Caucasus, locusts are a regular pest. Turning to Asia, the whole southern half of this enormous continent, except the highest mountains and plateaux, is ravaged by locusts from time to time; and the northern grasslands of Siberia are subject to a regular plague of grasshoppers, which are the nearest kin of locusts. The continent of Africa is wholly in the danger zone, and the devastations caused there by locusts during the last few years are well known. In South America, Argentina is not the only country that has to pay a heavy tribute to locusts, and other states of that continent suffer no less heavily. In North America, as in Siberia, locusts give place to grasshoppers, but the problem of their control is essentially the same. The smallest and the remotest continent of Australia, although still little developed agriculturally, has already had several warnings of impending catastrophes, and only last year wide areas were devastated by locusts.

Naturally, the species of locusts are not the same in every continent and country, and their habits vary to some extent, but the essential features of the locust problem are amazingly similar everywhere.

The first characteristic of the problem is that the areas covered by locusts in their migrations are very much greater than in the case of most other insects. As a result, swarms arising during a given season in one country may soon spread beyond its borders and invade distant territories. An excellent example is offered by the movements of the Migratory Locust in Africa during the recent outbreak. It is now established beyond any doubt that the first small swarms of this locust arose about 1926 in the inundation areas of the Middle Niger, south-west of Timbuctu, in the French Sudan. Spreading gradually and increasing in number and

size after each breeding season, the swarms soon invaded the whole of West Africa, spread into the Anglo-Egyptian Sudan, then swept into East Africa and crossed the continent once again from Rhodesia into South-West Africa. These developments may sound almost fantastic, but they have been followed year by year, and it took only five years, during which ten successive generations were produced on the way, to accomplish a double crossing of the continent and to invade the greater part of it.

Similar extensive wanderings of locust swarms have been repeatedly observed in other countries, and their complete disregard of international boundaries suggests the futility of ever finding a solution of the locust problem, except on an international basis.

The necessity of international co-operation in locust control has often been stressed, but the type of co-operation usually visualised is as useless for the real solution of the locust problem as the sporadic defensive measures practised in each country. It is often suggested in the countries spending large amounts on locust control within their own borders, that a similar energetic anti-locust policy in every other country would lead to a speedy and complete extermination of the pest. This is a complete fallacy, since the numbers of swarms, to say nothing of individuals in them, are so great that a simple calculation should show the impossibility of completely exterminating them. Indeed, if a pair of locusts produce only a hundred offspring (and this is a most conservative estimate) the destruction of even 98 per cent. of the offspring would result in the number of locusts remaining the same as before. There is no doubt that this percentage of destruction is practically unattainable, except in the most densely populated and highly civilised countries. When a continent like Africa has to be cleared of locust swarms wandering over its deserts, dense bush and swamps, it cannot be hoped that success can be achieved even by a universal anti-locust campaign. The cost of such a campaign would be, of course, expressed in astronomical figures, and in some of the most dangerous areas there will not be found sufficient man-power to carry it through.

Clearly, other strategical schemes have to be devised to deal with this formidable pest. A sound basis for such schemes has been provided by some results of the more recent studies of the problem. We have seen already that in the case of the Migratory Locust the invasion involving the greater part of the continent of Africa has originated in a single relatively small area. Again, it is almost certain now that the swarms of the dreaded Red Locust, now invading practically the whole of Africa south of the equator, arose some years ago in two or three small areas in Northern Rhodesia and Tanganyika Territory. In the case of the Desert Locust, which constitutes a grave menace to crops and most particularly to cotton, in West Africa, the Sudan, Iraq and India, there is every reason to hope that the original sources of its outbreaks will be discovered before long, some of them being already known. The swarms of the Moroccan Locust, a dreaded pest of crops in all Mediterranean countries, in Iraq, Persia and Turkestan, may spread over whole provinces, but the swarms have their origin in narrowly defined areas, with peculiar soil and vegetation conditions. No comparable investigations intended to discover the original sources of swarms have been organised in other parts of the world, but even the incomplete knowledge in our possession of the locust problem there, leaves no doubt that the same state of things will be found everywhere. Outbreaks of locusts always commence by the formation of a few swarms in relatively small areas, with peculiar natural conditions, and the invasion then gradually spreads over the whole country and beyond its borders.

The importance of this general finding for devising a sound anti-locust policy is not difficult to understand. It means that once the *outbreak centres*, as they are called, are located, it would become a relatively simple matter to keep them under constant observation, and to suppress the incipient outbreaks in their earliest stages, when the swarms are neither large nor numerous. This policy would result in effective *prevention of invasions*, which is, of course, vastly better than the purely defensive policy, which has been, and still is, practised in all the countries.

The cost of the preventive policy is certainly well under that of controlling, or attempting to control, the swarms which have spread over the whole country, while in addition all losses to crops would be eliminated.

The difficulties in organising a preventive control of locusts, as outlined above, are mainly psychological and political. It is a common human failing that a danger is seldom realised until it is too late, and it is easily forgotten when it is past. Since locust swarms appear only periodically with clear intervals of several years, it is not easy to persuade those whom it concerns to spend even a small amount in order to prevent an invasion when there is as yet no sign of it. Once the swarms appear and a panic sets in, the costs are not counted, and the money and labour are wasted in the hopeless struggle against an overwhelming enemy. When the swarming period is over a victory is proclaimed, and it becomes practically impossible to convince those in authority that the respite is only temporary and a new invasion is certain to come within a few years. It finally comes "unexpectedly," and the whole story begins all over again.

Until recently, this short-sighted policy had its justification in the insufficient knowledge of the habits and the sources of locust swarms. Now, as we have seen above, it has been convincingly demonstrated with regard to several locust species that the policy of prevention can be based on the soundest possible foundation.

The first step towards such a policy in the case of each species of locusts would be a thorough investigation of the course of invasions, in order to discover the outbreak centres. Owing to the disregard of all boundaries by locust swarms, these investigations must be international in their scope and cover the whole territory over which the particular locust species can migrate. It is exactly on this basis that the locust investigations in Africa and Western Asia have been organised by the British Government. The countries within that immense territory agreed to submit monthly reports on the locust situation to the Imperial Institute of Entomology, London, which is recognised as the International Centre of Anti-Locust Research.* These reports, accompanied by maps showing the breeding places and the movements of swarms,

are carefully studied, and general maps and reports are prepared. These summary reports permit the Institute specialists to discover the main lines and directions of migrations, as well as the areas suitable for breeding. By following the reports back to the earliest stages of the invasion, it proved possible to trace the swarms to their original sources or the suspected outbreak centres.

The next step was to investigate these supposed outbreak centres on the spot and to define them more closely. Several entomologists entrusted with this task were sent by the British, French, Indian and Belgian Governments to carry out these investigations. Some areas have already been surveyed and important practical conclusions have been reached, but the territories to be studied are very extensive and some of them difficult of access. The work is, therefore, not yet accomplished, though the end can be visualised within the next few years.

With regard to one locust, however, the Migratory, the task of preliminary surveys can be considered completed, and the problem of that locust is already ripe for a practical organisation of preventive control. It is, however, one thing for the scientists to show the rational way to the solution of a problem, and quite another to hope that the necessary steps will be taken to reach it. In this particular case the difficulties in the way of practical steps are aggravated by the necessity to create an organisation which would be international in its scope. When a single outbreak area presents a source of danger to the whole continent, it is only natural that all countries should take an active part in organising the permanent control in that area. The task of creating such a permanent organisation appears a difficult one, but it belongs to the sphere of politicians, not of entomologists.

The case of the Migratory Locust in Africa is, however, an extreme one. With some other species the problem is less formidable, since they are more localised, and often an outbreak area supplies locust swarms only to a single country. Such is the case, for example, with the Moroccan Locust, a notorious pest in some cotton-growing countries. The present writer's investigations in Turkey and Iraq, and M. Pasquier's detailed studies in Algeria, proved definitely that this locust

can be easily kept under control in a single country. Indeed, an organisation for the supervision of outbreak centres is already *functioning* in Algeria, and there is every reason to think that this means the end of invasions of that country by this locust. The cost of the permanent organisation, which should be counted as an insurance premium against invasions, is very slight, compared with the periodic expenses of controlling the invasions. Unfortunately, other countries, even where the preliminary research work has been done, still prefer the time-honoured system of waiting for swarms to begin their ravages before anything is done to control them.

To conclude, the investigations and the experience of the last few years go a long way to prove that the great locust problem is not impossible of solution. This solution can come, however, only through a broad organisation of research into the original sources of outbreaks. The investigations should supply the essential facts for developing a comprehensive preventive policy in the natural area of each locust species. In both stages of work, the success depends on an effective international co-operation, and on an efficient central organisation. Given these two conditions, the locust problem will soon lose its tremendous importance, though a constant vigil will be necessary in the outbreak areas.

It is a hopeful sign that the idea of international co-operation in anti-locust research designed to develop a preventive policy is now finding an almost universal recognition. This policy has been fully endorsed by an international locust conference held in London in 1934, at which thirteen countries were represented. At the next conference, to be held at Cairo in 1936, it is hoped to extend the international anti-locust schemes to all the countries of the world suffering from this oldest and greatest enemy of agriculture.

Water in the Diet of Live Stock*

By LL. E. W. BEVAN, M.R.C.V.S.

At the present time, when we are enjoying a bounteous rainfall, it is difficult to recall the serious period of drought from which we have but recently emerged, or to contemplate that upon which we shall shortly be entering. In order, therefore, that we may make the best use of water when we have it in abundance, and may take steps to conserve it for use when it is less plentiful, a few timely notes on the importance of a good and sufficient water supply in the raising of stock may be of value to readers of the *Journal*.

One of the prime necessities for the preservation of health and condition in animals under domestication is a good and plentiful supply of water. "Pure water," that is to say, water without any substance in solution or suspension, seldom if ever occurs under natural conditions, but "good water" in the hygienic meaning of the term, that is, water which is colourless, tasteless, odourless, not too hard and without organic impurity, is procurable on most Rhodesian farms.

It is not proposed to deal at length with the *mineral impurities* which our waters commonly contain, since these are generally insufficient to bring about any harmful effect.

Accidents are occasionally reported from cattle drinking in the neighbourhood of mines, but deaths due to arsenic and the contamination of the drinking supply by "cattle dip" are all too frequent, and it may be well to reiterate here the warning which the Chief Veterinary Surgeon found it necessary to publish in a previous issue of this *Journal*, pointing out the dangers associated with the careless handling of this poisonous drug.

The *organic impurities*, however, must receive closer attention. They are of two kinds—animal and vegetable.

*Extracts reprinted from *Journal*, April, 1915.

The latter are not as a rule serious, unless in large quantities; they usually result from plants growing in, or leaves falling into, the water. They may affect the colour and taste, but living vegetable matter is seldom injurious; indeed, by its oxidising powers it may to some extent tend to purify the water.

Animal impurities are again of two kinds:—(1) those emanating from healthy men and animals, (2) from men and animals affected with some specific disease. The first are objectionable on account of their bad smell and taste, and also from the injurious effects on the animal's body from the ingestion of the solutions of animal materials.

On the other hand, water is contaminated by impurities, such as the excreta from diseased animals, which may convey infection to those partaking of it.

Some of the *pathogenic organisms* which may thus be derived from an impure water supply may be briefly referred to.

Fortunately in this country many of the microbial diseases which elsewhere are water-borne, such as glanders, anthrax, swine fever, foot and mouth disease and rinderpest, do not at present exist. One disease, however, which has been recently introduced into this country, namely, contagious abortion in cattle, may be contracted by the pregnant female drinking the water contaminated by the discharges containing the specific bacillus from a cow which has previously aborted.

Parasitic diseases, however, are much more commonly spread in this way. The eggs of the tapeworms and wireworms have frequently been found in polluted water, and the liver fluke depends upon a water snail living in or around wet places.

On a great many farms during the dry season, the only water available for stock is limited to that remaining in dams and water pools, and this becomes so highly polluted by the excreta of animals constantly collected around it or actually standing in it, that it eventually constitutes a veritable death trap. A single animal infected with intestinal parasites, such

as tapeworm or wireworm, will deposit in its fæces many thousands of eggs, which will find in the moisture of such places conditions favourable for existence, until they are taken up by a suitable host in which they can multiply and continue their life cycle. When it is remembered that a few eggs developing into mature parasites may give rise to many millions of eggs, which in turn pass out in the fæces of the infected animal, it is easy to understand how highly dangerous such water is, and how whole flocks and herds may eventually become infected by drinking it.

Such parasites, once established in their host, produce their ill effects in an insidious but none the less disastrous manner. Many of them do so by simple mechanical crowding or by setting up a continuous irritation, and so interfering with digestion. Some derive from their hosts the products of the processes of digestion; those possessing a digestive apparatus ingest these materials, others more simply organised absorb them by osmosis. Others extract large quantities of blood, and so cause anæmia, while others again give rise to toxins or poisonous substances harmful to their hosts.

It is possible that an animal otherwise in good health may for a long time resist or tolerate these parasites, but when unfavourable conditions such as those associated with the dry season and prolonged drought reduce its vitality and powers of resistance, it falls a victim to the constant demands of its invaders, or becomes the easy prey of other diseases to which its enfeebled condition renders it unusually susceptible.

It is easy to understand that an animal continually robbed of the material necessary for nourishment and maintenance has not that surplus necessary for growth and cannot thrive and develop as a healthy animal; and since it is the aim and object of every stockman to produce meat or milk for the market, these parasites are, apart from the actual death of animals, a source of considerable financial loss to him.

The amount thus lost in this country must be enormous. It may truthfully be said that scarcely a sheep exists in Rhodesia which does not harbour one or more species of intestinal worm, and this to a large extent explains the fact

that we are compelled to import annually from without more than £50,000 worth of mutton for local consumption. Fortunately cattle are not so frequently affected, but during the past year on one estate alone three hundred head died either directly from verminous infestation or indirectly from the result of diseases associated with it. Both cattle and sheep have died from "fluke," which has become widely established during recent years. Horses, mules and donkeys also suffer from intestinal parasites.

It must be remembered also that temporary collections of water are most favourable for the breeding of mosquitoes, which transmit malaria to man and possibly horse-sickness to equines, and the experience of the present season clearly shows the necessity for taking every precaution against these deadly diseases.

Enough has been said to indicate the dangers associated with impure waters: let us now discuss the benefits to be derived from a good and plentiful supply.

"If we recall that water is of the very greatest importance for the normal physical conditions of the tissues, that the solution of numerous bodies and the dissociation of chemical compounds, that all flow of juices, all exchange of material, all supply of food, all growth or destruction, and all removal of destructive products, are connected with the presence of water, and that besides this the water by its evaporation is an important regulator of temperature, it is evident that water must be a necessity of life." (Hammersten.)

Or, as explained by Mr. Place in the address previously referred to, "Water is of the highest importance in all the processes of change in the animal body which are spoken of as life, and it is especially so in the processes connected with digestion. It helps in chewing; by it the food is rendered fit to be absorbed by the bowels; it is the chief carrier of nutriment to the system, for without a sufficiency the blood is unable to utilise the food offered to it; its evaporation by the skin and lungs is one of the chief means of keeping the body at a suitable temperature; and its presence is absolutely necessary in the metabolism of the food, those intricate changes which transform the vegetable cells into fit food for animal tissues by such marvellous processes that even the

balance of the chemist is not able to check the minute alterations that take place. When water is not present in sufficient quantity, the processes of digestion are slowed down, and those of waste removal checked, so that poisons form in the system which would not otherwise do so, and the products of protein digestion rapidly change into virulent poisons. When the blood is too thick from loss of water, the body temperature rises and the system becomes more liable to attack by those poisons, and the young, both before and after birth, are seriously crippled in their struggle for existence, while thirst diminishes the desire for food, purging, vomiting, paralysis ensue, and death does not loiter on its way."

The animal body is made up of proteids, fats, salts, water, and a very small proportion of carbohydrates. Every food must either contain these principles, or be capable of conversion into them within the animal body.

The following table from Lawes & Gilbert shows the relative proportion of these in oxen, sheep and pigs in store condition:—

	Ox.	Sheep.	Pig.
Water	60.8	63.5	61.2
Proteids	18.0	15.0	14.0
Fat	16.0	18.0	22.0
Ash	5.2	3.5	2.8

The quantity of the water in the organism decreases with increasing age, a fact of practical importance, and to a large extent explaining the "leathery" condition of the meat derived from the worn out trek ox or antiquated cow frequently supplied for local consumption, and emphasising the necessity for producing a class of cattle of earlier maturity than we possess at the present time.

The quantity of water in different organs varies. While the enamel contains only 2 p.m. water and the teeth about 100 p.m., the fatty tissues 60-120 p.m., the bones 140-440 p.m., and cartilage 540-740 p.m., the muscles, blood and glands are far richer, containing from 750-800 p.m.

The following table is collected from figures published by Lawes & Gilbert at Rothamsted, England, and from experiments conducted at the Maine Experimental Station:—

Water in Entire Body.

Ox, well fed	L. & G.	66.2	per cent.
Ox, half fat	,,	59.0	,,
Ox, fat	,,	49.5	,,
Steer, 17 months old, medium fat...	M. E. S.	59.0	,,
Steer, 17 months old, medium fat...	,,	56.3	,,
Steer, 27 months old, fat ...	,,	51.9	,,
Steer, 27 months old, fat ...	,,	52.2	,,
Calf, fat	L. & G.	64.6	,,
Sheep, lean	,,	67.5	,,
Sheep, well fed	,,	63.2	,,
Sheep, half fat	,,	58.9	,,
Sheep, fat	,,	50.9	,,
Sheep, very fat	,,	43.3	,,
Swine, well fed	,,	57.9	,,
Swine, fat	,,	43.9	,,
Chicken flesh	,,	74.2	,,
Fowl flesh	,,	65.2	,,
Goose flesh	,,	42.3	,,
Turkey flesh	,,	55.5	,,

Thus we learn that considerably more than half the body weight of the calf and nearly half that of the fat ox is water. In extra-fat sheep the water content falls to 43.3 per cent., the lowest of all farm animals, while for the fat pig it is 43.9 per cent. Generally speaking, about half the weight of the bodies of our domestic animals is made up of water—a fact which should appeal to the pocket of every Rhodesian stockman.

It may, however, be noticed that in the above table the lean animals contain a much higher proportion of water than the fat, but this must not be taken as a justification for starvation. "It does not mean that in the process of fattening, the fat is substituted for water, and so expels it from the organism, but that the increase has a much smaller percentage of water than the body in its original lean condition." (Bailey.) It explains to some extent the common experience that in fattening an animal, more is required to "set it going" than to maintain it when once in good and thriving condition.

The Rhodesian year is made up of two seasons, the wet and the dry, the former characterised by an abundance and often an excess of water and succulent feeds, the latter by an absence of natural green-stuff and often a serious shortage of water. During the greater part of the wet season our cattle are well fed, fat and make good growth, but during the rest of the year, which is roughly about five months out of the twelve, this condition is lost; the animals cease to grow, and not infrequently die from starvation and inanition.

"When an animal is starved, it lives on its own tissues. If water be given, life is considerably prolonged. Colin records a case where a horse receiving water lived thirty days without food. It is notorious that herbivora, though they lose less proteid during starvation than carnivora, do not withstand starvation so well. It has been found by experiment that old animals bear starvation much better than young growing ones, as their requirements are smaller." (Smith.)

During starvation water passes uninterruptedly from the body, even when none is taken in. *This is obtained from the tissues themselves;* indeed, "the liberation of water from the tissues is generally sufficient to supply the loss of water, and starvation is ordinarily not accompanied with thirst." (Hammersten.) If, then, during the dry season, with the shortage of food there is also an inadequate supply of water, the demands upon the animal body are intensified, and the damage wrought is often irreparable. In other words, animals which receive a check seldom entirely recover from it. Unfortunately, in this country, while cattle make quite exceptional growth during part of the wet season, they frequently "stand still" or actually "go back" during four months of the dry season, and take another four months to recover what they have lost. Thus we do not get the early maturity and the tender meat of stock which are "kept going" all the time. When at our local fat stock shows an exceptional fed grade animal of 3½ years yields 600 to 700 lbs. dressed weight, it has no difficulty in beating the hardy veterans competing against it. Out native stock is still growing at six years, and seldom reaches these weights when fully grown.

Stockmen are too liable to stock their farm according to its carrying capacity during the summer, entirely forgetting

the coming period of drought, and neglecting to provide for the winter either a food or water supply.

In a recent report of the Trades Commissioner in London on a consignment of South African beef (*ex* s.s. "Balmoral Castle") which was placed on the market at Smithfield at the beginning of the first week in December last, and consisting of 100 hind quarters and 200 fore quarters, he says, "The principal lesson to be derived from the experiment is, I think, that a better class of cattle must be produced if ever the Union wishes to enter the meat trade with success. Hanging side by side with Argentine and Australian quarters, the deficiencies in our own meat were too obvious. No amount of dressing or grading can ever compensate for the poor quality and condition of inferior meat, and this lesson should be taken to heart by our farmers."

These remarks refer, it is true, to a consignment of beef from the Union, but the advice should also be taken by the Rhodesian farmer, who cannot hope to successfully compete in the world's markets with beef from animals which have reached a ripe old age, in spite of a vicarious existence of alternating plenty and starvation.

The principal object of every breeder should be to bring his cattle to early maturity, so as to place them on the market as quickly as possible, remembering that *the cost of gain in weight increases and the quality of meat decreases with age.* If a calf born weighing 50 lbs. were to increase $1\frac{1}{2}$ lbs. a day for the first month and 1 lb. a day subsequently until 40 months old, it would then weigh about 1,200 lbs., which, dressing at 60 per cent., would give a carcase weighing about 750 lbs., which is about the weight and quality required in ordinary commercial stock, and, of course, very much below that required in animals for show purposes.

These figures, however, are seldom achieved in this country, even in our prize winners. To begin with, our Rhodesian calves seldom weigh as much as 50 lbs. at birth (their mothers having had to weather the dry season during the last few months of the calf's existence *in utero*), and being born in spring they usually contract redwater and gall-sickness, and suffer from anæmia, so that they have not that surplus of

blood necessary for growth. Still more unfortunately they wean about the time of the dry season, and are ill able to subsist upon the dry and meagre fare available. With the commencement of the next grass season, when about a year old, they make a certain amount of growth until once more they are checked with the winter shortage of food. Year by year this goes on until by the time they present a marketable size their meat is inferior in quality and quantity, and only suitable for canning or for the local market.

The quantity of water required varies with the different classes of stock, with the climate, season and temperature, with the food and with exertion or exercise. Range cattle require from 4 to 8 gallons a day, but milch cows require a more generous supply, not only for maintenance, but for the production of milk, whether for the calf or the bucket. Cattle, and more especially cows, should have all the water they desire *without being compelled to "trek" long distances to obtain it.*

Horses and mules require from 4 to 6 gallons a day, and when possible should be watered first and fed afterwards. The water which they drink does not remain in the stomach, but passes immediately into the small intestines and in the course of a few minutes passes along the 72 feet of small intestines and reaches the cæcum, or "blind gut," which in a medium sized animal has a capacity of about 4 gallons. The influx of a considerable quantity of fluid into a stomach containing food washes it out of the stomach before it is properly digested, and sweeps it into the intestines, where it may set up irritation or colic. Undigested material is also liable to ferment and give rise to gases. This is a common cause of colic in mules, which, after their morning feed of mealies, are hustled off on their first trek before they have had time to digest them. Arriving at water they drink greedily, with the result that soon after they become "blown up," suffer intense agony and frequently die. Next to horse-sickness, this is probably the principal cause of death of equines in Rhodesia.

It is recognised that horses and mules in this country will not drink till the sun is well up; therefore, to avoid this

accident they should receive their heaviest feed at night and only a light meal at least an hour before being inspanned in the morning.

Sheep should have from one to six quarts of water daily, according to feed and weather. It is often stated that sheep require no water, and in countries with heavy dews and where ample succulent food is available water may possibly be denied them, but under the conditions of our country it is a necessity, and should never be withheld. One authority states, "I have noticed that wherever sheep are fed so that they will not drink water, they are fed in nearly the proper manner . . . the nearer we come to it the nearer we are feeding in a perfect way."

Place reproduces the following very striking figures:—"For every pound of dry food, the pig requires 7 lbs. to 8 lbs. of water, the cow 4 lbs. to 6 lbs., and the horse 2 lbs. to 3 lbs., just as a maintenance ration." He adds, "Food and drink, little and often, for the working horse will keep him fit and free from sores and ailments. Succulent food will supply half the cow needs, and nearly all the sheep wants, while the pig will thrive much faster if he has a liberal supply of wash than he would on dry stuff only; and with them all that is the end and aim of their existence, to give the better return in the shortest time for the least cost."

Let us now consider how water can be provided for the use of stock in the dry season.

In the first place, water constitutes a large proportion of the weight of all living plants, especially during the period of active growth, part of it being contained in the tubes and intercellular spaces of the stalk and leaf. This is the "vegetation water," as distinguished from sap or plant juice. Sap is more than water, inasmuch as it holds in solution certain substances, such as sugars and salts. When the plant is dried, these soluble compounds do not pass off, but remain behind as part of the dry matter.

The proportion of water in plants varies according to the stage of growth. Immature plants contain more water than older or mature ones. Young pasture grass is more largely water than the same plants would be after the seed is formed.

While our green pasture grasses contain water varying in quantity from 50 to 75 per cent., hay contains only from 7.5 to 10 per cent.

It is true that as far as the chemical analysis is concerned, by adding to a given quantity of hay the amount of water lost in curing, a material is produced containing the same chemical elements, *viz.*, proteids, fats and carbohydrates, in the same proportion as the grass from which the hay was made; but the feeding value of the material also depends upon its palatability, digestibility and assimilability, and in this respect it is found in practice that, at any rate as far as cattle are concerned, the natural water contained in the food is of greater value to the animal than dry food plus a compensating quantity of drinking water. Thus it follows that one of the best ways of conserving moisture for the winter is in the form of succulent feed.

The usual "stand-bys" in this country to supplement the natural grazing in the dry season are hay, mealies, and mealie stalks. More often than not the hay is badly saved, because the rains often prevent the cutting of hay at the best time when it contains the highest food content; that is, before the grass has reached maturity or the nutrient matters in the stem have passed into the seed with loss of protein. In the growing plant the carbohydrates become less, owing to the conversion into cellulose, so that the older the plant the more cellulose and the less starch and sugar substances it contains. Local hay is frequently cut when the grasses have lost their grain, flavour and aroma, and have become woody and indigestible. The best saved hay seldom contains as much as 15 per cent. of water, and much of that is lost during storage. On the other hand, hay saved too moist is liable to fermentation and heating. From this it will be seen that veld hay, even when well saved, will supply but a limited portion of the water necessary in the winter diet.

Nor does maize supply the deficiencies of the winter grazing, as it contains only some 12 per cent. moisture and 10 per cent. proteids, the greater part of the balance being made up of carbohydrates. Great importance is attached by some farmers to mealie stalks as a winter feed to "tide over" the drought, but from the analysis it appears that corn stover

only contains 37 per cent. digestive nutrient, as against 63 per cent. in the grain, although relatively high in water content, sometimes yielding as much as 40 per cent. The virtue of the practice lies in that fact.

One way of conserving the natural plant succulence of the summer for use in the winter is by the making of ensilage.

In a very comprehensive article appearing in the February issue of this *Journal*, Mr. J. A. T. Walters, B.A., Assistant Agriculturist and Botanist, showed how almost all forage plants could be used in the production of ensilage, and among others enumerated maize—"undoubtedly the forage plant *par excellence* for the making of ensilage"—kaffir corn, manna or millet, veld hay, Napier's fodder, teosinte, pearl millet, paspalum or any other hay, velvet beans, lucerne, cowpeas, kaffir beans, Egyptian clover, beggar weed, field peas, ground nut tops, dahl, sunflower heads, and others. An ideal ensilage contains about 75 per cent. of water.

The majority of the crops enumerated in this list need to be cultivated, and this brings us to the necessity and importance of cultivation as a means of conserving moisture, to be made use of in the form of winter crops. Most of the cultivation carried on in this country is for the raising of summer crops, but there are a few plants which continue to make use during the winter of the water conserved by cultivation during the summer. Of these, two of the most useful are sugar cane and the Zinya munga (or Napier's fodder), so frequently referred to in previous issues of this *Journal.*

The following analysis by the Agricultural Chemist shows the value of these plants as a winter feed:—

Particulars of Planting, etc.

	Time planted.	Collected.	Sample for analysis. Length of stalk, in feet.	Length of leaf, in feet.
Sugar Cane	Jan., 1910	July, 1911	2	4
Zinya Munga	Mar., 1910	July, 1911	8	2

The fodder had not been cut down since planting.

Analysis.

	Sugar cane fodder.	Napier's fodder.
Water	73.63 per cent.	61.81 per cent.
Ether Extract (fat)	0.22 ,,	0.29 ,,
Protein (Nitrogen x 6.25)	1.27 ,,	2.92 ,,
Carbohydrates	17.73 ,,	17.29 ,,
Woody Fibre	5.32 ,,	14.77 ,,
Ash	1.83 ,,	2.92 ,,

Root crops, pumpkins and melons belong to the same class. Of these, majorda melon has proved of great value. The following is a report by the Agricultural Chemist on a sample:—

Water	94.63 per cent.
Fat	0.03 ,,
Albuminoids	0.44 ,,
Carbohydrates	4.12 ,,
Fibre...	0.43 ,,
Ash	0.36 ,,

This sample was obtained from a small plot at the Gwebi Experimental Farm. "The melons were planted in hills 12 by 12 feet apart. The hills were lightly dressed with kraal manure. The yield per acre was at the rate of 24 tons. These cattle melons kept excellently, were well liked by the stock, and were not fed until August and September."

Pumpkins, turnips and mangolds yielding about 90 per cent., and sweet potatoes about 70 per cent. of water, are also useful.

Rape and kale are now being grown in some districts with success. They contain up to 85 per cent. water, but being harvested up to July, are finished before the critical months of drought.

A man who has invested a large sum of money in a number of cattle, or in stock of improved breeding, cannot afford to see these animals "standing still," or actually losing weight and development for five months in the year. It is

as necessary for him to supply winter feed for his stock, as it is for a railway company, if it wishes to pay a dividend, to supply fuel for its engines. Thus, it may become necessary for him to grow crops such as green oat forage, barley, lucerne, etc., under some system of irrigation, whether by a gravitation or pumping scheme. There is no business in which the old saying "time is money" is more true than in stock raising. The whole object of the breeder is to grow as much good meat as possible in the shortest time. In one of the latest meat market reports for England we find, "the day of big coarse joints has long since come to an end, and at the present time the public demand is for smaller joints *with meat of high quality*." This is a very different thing to the meat obtained from our local undersized, underfed animals of doubtful age. The same article states "*by withholding a sufficient allowance of proper foods, animals take twice as long as they should to do their work, and the meat is not of such good quality. To make winter feeding a financial success, it is essential to get quick returns from the stock fed, so as to secure a big turnover.*" And since in Rhodesia for six months in the year nature supplies a good and sufficient diet for his stock, it should pay the breeder to provide during the winter sufficient succulent food to maintain the growth made in the summer.

In addition to that available from succulent food, a certain quantity of drinking water is essential. This should be as pure and plentiful as possible, and easily procurable when desired. Many of our farms have a river frontage with running water available throughout the year; but it frequently happens that the approaches to the river are few, and the watering places limited. Here collections of water become shut off and fouled by the excreta of animals. This state of affairs is far worse when, during the winter, the river dries up, leaving behind a few muddy water pools.

The same objections apply to dams and collections of water in low-lying places; these in the dry season become veritable death traps. It is a matter of practical experience that cattle on farms with a supply of clean water and a shortage of food do better than cattle on farms where the grazing is better but the water is polluted.

To summarise:—

A good and plentiful supply of water is one of the prime necessities for the preservation of health and condition in animals under domestication.

Nearly half the body weight of these animals is water.

The object of stockmen is to grow the largest quantity of good meat in the shortest possible time. To do this, a supply of succulent food and water is necessary.

Any check in development is harmful and equivalent to a loss of money.

The majority of animals in Rhodesia suffer such a check during the "dry season," owing to the shortage of succulent food and water.

Frequently the only water available is highly polluted, and contains disease-producing parasites.

Unthrifty animals drinking such water are particularly susceptible to disease, and the mortality among them is therefore high.

The financial losses from such deaths, to say nothing of the reduced market value of all classes of live stock, justify some capital expenditure on the provision of a good and adequate water supply, if not an irrigation scheme for the production of winter crops.

In view of the growing demand and the improved prices for meat on the world's markets, such an investment should be amply repaid.

Fertilizers, Farm Foods, Seeds and Pests Remedies Ordinance, 1914.

The Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance first came into force in July, 1914, at a time when the quantity of fertiliser imported into the country was extremely small.

During the past ten years the sale of fertilisers has greatly increased, as is evidenced by the fact that in 1924 the value of the fertiliser imported was £26,479, whereas in 1927 the value had increased to £146,702.

Many changes have taken place in the manufacture of fertilisers, and not only has the physical condition of many of the old standard chemicals, such as superphosphate, been improved, but a considerable range of new and more concentrated chemical compounds has been introduced by fertiliser manufacturers.

Although from time to time amendments to the orginal Ordinance have been made to meet new circumstances, it is not surprising that the interpretation of the terms of the Act is sometimes difficult, and confusion occasionally arises in the minds of importers of fertilisers as to how the manner of describing the composition of a fertiliser laid down in our regulations can be made to fit in with the description given by manufacturers in the country from which the fertiliser is being imported and where the particulars of the chemical composition may have to be described in a different manner. For example:—

When selling sulphate of ammonia the vendor in this country is required to give the purchaser a guarantee as to the percentage of nitrogen (N) contained in the sulphate of ammonia. In the country from which the sulphate of ammonia was imported it might be sold and guaranteed according to its ammonia (NH_3) content. In the first case, the sulphate of ammonia would be guaranteed as 20.5 per cent., and in the latter 24.9 per cent.

In the event of a vendor in this country selling such sulphate of ammonia as 24.9 per cent., it would be taken to mean that the product contained 24.9 per cent. nitrogen (N), whereas in actual fact it would only contain 20.5 per cent. nitrogen, and under such circumstances the vendor would render himself liable to prosecution. The object of laying down definite rules as to the manner in which fertilisers are to be described is not to confuse the seller, but to protect the purchaser, as well as competitor firms, from terminology which might confuse the buyer in assessing the value of the product which he is purchasing. It frequently happens that importers of fertilisers are put to considerable inconvenience and expense through having consignments held up in the Customs owing to the fact that the regulations laid down under the Act have not been properly adhered to or that the particulars contained in the advice or consignment notes differ from those given by the importer when registering the product with the Department of Agriculture.

Although every assistance is given to importers, both by the Customs authorities and the Department of Agriculture, it must be realised by all manufacturers and importers that the various officers concerned cannot depart from the terms of the regulations as laid down, and that it is incumbent upon them to acquaint themselves with the terms of the Act and to inform the overseas firms from which the fertiliser is being purchased of the requirements to be observed.

It is thought that the following explanation of a number of clauses in the regulations might assist vendors and importers of fertilisers in acquainting themselves with certain of the requirements over which frequent difficulty arises.

Registration.—Every importer or manufacturer of a fertiliser or farm food is required annually to register such fertiliser or farm food with the Secretary, Department of Agriculture, before the 31st March, and each certificate of registration expires on the 31st March of the year following registration.

Any fertiliser or farm food of which the certificate of registration has expired is deemed to be unregistered, and until such product has again been accepted for registration it is not allowed to enter or be sold in the Colony.

Registration application forms are obtainable from the Secretary, Department of Agriculture.

All fertilisers or farm foods, whether imported for sale or for private use, must be registered before they are allowed entry to the Colony. In completing the form of application for registration careful attention must be given to all the particulars required and the percentage composition of the product must not be stated beyond the first decimal place.

Nitrogen and Potash.—In the case of fertilisers containing nitrogen or potash the form in which the nitrogen or potash is present must be stated in the registration form.

If the nitrogen or potash is present in more than one form, it must be stated and details of the various forms given.

In the case of nitrogen it must be stated whether it is present as nitric nitrogen, ammoniacal nitrogen, or organic nitrogen. If the nitrogen is present in the form of nitrate, the base must be stated, *i.e.*, soda, potash, calcium, and, if in the ammoniacal form, the acid radical must be given, *i.e.*, sulphate, phosphate, chloride, nitrate, etc. Where nitrogen is present wholly or in part in organic form, the source or sources of the organic nitrogen must be given, *i.e.*, blood, meat, fish, etc.

In the case of potash it must be stated whether the salt incorporated in the fertiliser is the sulphate, chloride, or nitrate, or a combination of two or more of them.

Phosphoric Oxide.—There are many forms of phosphatic fertilisers on the market and, as the solubility of the phosphoric oxide in these products is of some importance in agriculture and the cost of phosphatic fertilisers is largely controlled by the relative solubility of the phosphoric oxide contained in them, it is necessary that specific standards of solubility should be taken cognisance of in estimating the agricultural value of these various phosphatic fertilisers. Four different standards of solubility are mentioned in the Act in connection with the registration of fertilisers containing phosphoric oxide. These are:—

1. Water soluble phosphoric oxide.
2. Citrate soluble phosphoric oxide.
3. Citric soluble phosphoric oxide.
4. Total phosphoric oxide.

It should be noted that it is not permissible under our Act to designate the quantity of phosphoric oxide in a fertiliser by other equivalents, such, for example, as 20% phosphoric oxide equal to 43.7% calcium phosphate; plain percentages of phosphoric oxide only are permitted. Difficulties sometimes arise through vendors of fertilisers not giving the correct particulars in the application for registration regarding the solubility of the phosphoric oxide in the fertiliser which it is desired to register.

In most instances it is necessary to state the water soluble, citrate soluble and total phosphoric oxide contained in the fertiliser.

Only in the case of the fertilisers basic slag, basic superphosphate, and raw phosphate rock is the solubility of the phosphoric oxide in 2 per cent. citric acid instead of citrate solution accepted for registration.

In the case of bonemeal and other bone products the citrate solubility, and not the citric solubility, must be given.

Marking of Parcels.—Some uncertainty exists in a number of quarters on the manner in which sacks or other packages must be marked.

According to the regulations, all receptacles in which any fertiliser or farm food is offered for sale or sold shall, in addition to the markings otherwise prescribed, *be legibly and durably marked with the registered brand.*

Certain additional markings are also required in most cases with the object of showing clearly whether the fertiliser is a low, medium or high grade product as defined under the regulations.

Statutory Statement.—Every person who sells any fertiliser or farm food is required to give or send to the purchaser or his representative at the time of delivery an invoice stating the quality sold, the name or brand under which the product is

registered and also the chemical constituents thereof which have been registered with the Secretary, Department of Agriculture.

The statement in the invoice shall be deemed to be a guarantee that the article is as described therein.

Any vendor of a fertiliser who

(*a*) fails to supply the necessary invoice;

(*b*) fails to insert in an invoice any particulars required;

(*c*) incorrectly states in an invoice any required particulars;

(*d*) gives in an invoice figures for the chemical constituents of a fertiliser or farm food which differ in any particular from those supplied on registration,

is guilty of an offence.

Where a person has sold or delivered any unregistered fertiliser or farm food and has supplied an invoice or any statement giving the chemical constituents thereof, which constituents are found on analysis to be less than so stated, such person shall be guilty of an offence for selling a fertiliser or farm food which does not comply with the guarantee given in the invoice or statement.

It should be noted that it is not permissible under the terms of the Act to state a range of percentages for any valuable ingredient contained in a fertiliser or farm food. It is considered that a single figure is sufficient, as in deciding whether a product conforms to its guarantee, a reasonable margin of variation from the guaranteed composition is provided for in the regulations.

Analysis of Samples.—Samples of fertiliser are regularly analysed on behalf of the Government by the official analysts appointed under the Act, but any purchaser of a fertiliser or a farm food is entitled, upon payment of the fees laid down, to have his fertiliser or farm foods analysed by the official analysts. It is essential, however, that the regulations in connection with the sampling of fertilisers or farm foods shall be strictly adhered to by any person desirous of having an analysis made of the product he has purchased. The regulations in connection with the sampling of fertilisers and farm foods laid down in the Act are as follows:—

"(1) Any purchaser of a fertiliser or farm food intending to submit the same for analysis by an analyst duly appointed under the Ordinance shall, within seven days after the delivery of such fertiliser or farm food at the railway station or at such other point as may be agreed upon mutually between the purchaser and the vendor, give written notice to the vendor or his agent of such intention, and in such notice he shall offer to divide, at the place of delivery, in the presence of the vendor or his agent or of a civil commissioner, magistrate, justice of the peace or police constable, or of any person appointed by a civil commissioner or magistrate in that behalf, a sufficient sample of the fertiliser or farm food into three parts, and each such part shall be forthwith fastened up and sealed and marked in such manner as its nature may permit.

"(2) Such notice, if not served upon him personally, shall be sent by registered letter through the post addressed to the vendor to his address as stated on the label, or to his agent at his usual place of business.

"(3) If required by the vendor or his agent to do so, the purchaser shall forthwith make such division, and shall—

"(*a*) deliver one of such parts to the vendor or his agent;

"(*b*) retain one of such parts for future comparison;

"(*c*) submit the third part to any analyst as aforesaid.

"(4) If the vendor or his agent does not, within five days from the date of such notice, accept the offer of the purchaser to divide a sufficient sample of the fertiliser or farm food in his presence or in that of his agent, and appoint a time, not being more than ten days after service of such notice, or does not attend personally or by agent at the time and place aforesaid, the purchaser may forthwith send a sample thereof, drawn and sealed in the presence of a civil commissioner, magistrate, justice of the peace or police constable, or of any person appointed by a civil commissioner or magistrate in that behalf, to an analyst under the Ordinance as aforesaid."

Cost of Analysis.—The prescribed tariff for the analysis of fertilisers or farm foods in terms of the Ordinance is £1. 1s. 0d. for a determination of any constituent, with a maximum of £4. 4s. 0d. per sample.

How to make use of the Fencing Law.

In terms of the "Fencing Ordinance, 1904," it is competent for any landowner to require his neighbours to join in or contribute to the construction of fences on mutual boundaries, in such proportion as may be agreed upon between them. To this end he should serve a notice in writing on the person he desires to contribute, specifying the boundary to be fenced, the kind of fences and mode of erection proposed. (*See specimen letters A.*)

If within three months no agreement is arrived at in respect of any of the above points, the matter is to be settled by arbitration. (*See specimen letter B.*)

If either of the parties fails to carry out any of the work of construction that he has agreed to do, or has been allotted by an arbitrator, the other party may carry it out and recover the share of the cost that the first party should have contributed, in any Court of competent jurisdiction.

The person called upon to contribute to the construction of a dividing fence may, by giving notice within one month of the amount being fixed for which he is liable, pay such amount by equal annual instalments, with interest at 6 per cent. per annum added. (*See specimen letter C2.*) If the capital amount does not exceed £100, the payments may be extended over five years, and if the amount exceeds £100, the payment may be extended over ten years. In a schedule to the Ordinance there is given a table for calculating the amounts payable every year for five or ten-year periods.

When an owner is absent or cannot be found, or any land is unoccupied, the owner of any adjoining land who wishes him to contribute to the cost of a fence must advertise at least once a month for three months in the *Gazette* and a paper circulating in the district, requiring him to contribute. (*See specimen notice D.*) He may then obtain an order from the Magistrate authorising him to proceed with the construction,

and in due course a certificate of the amount due by the owner of the adjoining land. This certificate must be lodged with the Registrar of Deeds, who will make an entry in respect of the land affected, which entry will constitute a hypothecation of the land.

Tenants, excepting those whose unexpired term of lease does not exceed one year, are liable to pay interest at the rate of 6 per cent. per annum on half the cost of construction, and tenants who have the right of purchase are liable to have any sum paid by the owner for construction of fence added to the purchase price.

Owners of land on either side of dividing fences are liable for the cost of repairs in equal proportion. An owner can serve on his neighbour a notice requiring him to assist in repairing such fence (*see specimen letter E*), and if the second owner refuses or neglects to do so, after one week the first owner can make the repairs and recover his share from the second. Fences destroyed by accident may be repaired without notice. If the fence is damaged through the neglect of either of the parties, he only is liable for the whole cost of repairs.

The Ordinance does not affect any substantial fence already erected at the time of the coming into operations of the Ordinance.

If the owner of any land shall have erected by 10th December, 1926, a fence on the boundary of his land, and any other pershon shall adopt any means by which such fence shall be rendered of beneficial use to himself, he shall be liable to pay the owner of the fence interest at 6 per cent. per annum on half the then value of so much of the fence as he makes use of, and shall also be liable for half the cost of repairs.

Any person erecting a fence on land covered with bush is entitled to clear the bush for a width not exceeding six feet on either side of such fence, and to remove any tree standing in the direct line of such fence. The cost of clearing may be added to the cost of the fence in cases where any part of the cost of the fence is to be recovered from another party.

Where a river forms the boundary of contiguous lands, but is not capable of resisting the trespass of animals liable to be impounded, it shall be competent for the owners to agree upon such a line of fence on either side of the river as shall secure such fence from the action of floods; and in the event of their not agreeing upon such a line of fence, and whether any or what compensation in the shape of an annual payment shall be paid to either party for loss of occupation of land, the question shall be settled by arbitration.

If the owner of any land shall clear the same of inflammable materials for the space of fifteen feet from any boundary fence, and the owner of the contiguous land shall neglect so to clear his land, such owner shall be liable for any damage done to the fence by fire due to such neglect, and is required to make good the damage within one month, failing which the neighbouring owner may make good the damage at the expense of the owner in default.

Every person engaged in constructing or repairing a fence under this Ordinance may enter upon the continguous lands, if necessary, at any reasonable times and do any reasonable acts thereupon that may be required for the construction or repair of the fence, but he may not enter upon any cultivated ground, garden, plantation or pleasure ground or cut down or lop any fruit or ornamental trees or shrub without the consent of the owner.

Any owner to whom any amount may be due by any person by way of contribution towards the construction of a dividing fence may call upon such person to pass a mortgage bond upon his land. (*See specimen letter F.*) If the said person shall refuse or fail to pass such mortgage bond the owner may notify to the Registrar of Deeds the fact that the amount is owing and no mortgage has been passed. (*See specimen letter G.*) The Registrar of Deeds shall then notify the person named, the fact and particulars of the notification received from the first party, and if no objection is lodged within three weeks the amount of the debt is registered in the Deeds Office and no transfer or mortgage on the property can be passed until the bond above referred to has been duly

passed. Should any objection be raised, no entry shall be made in the Deeds Office registers except with the consent of the said person or upon the order of a competent Court.

An "owner" is described in the Ordinance and amending Act as—

(*a*) Any person, company, co-partnership or public body in actual occupation of or entitled as owner to occupy any land alienated from the British South Africa Company, or entitled by virtue of any certificate or document conferring a right to claim any land from the British South Africa Company.

(*b*) The Council or other governing body of any Municipality or Corporate Town, in respect of all lands to which or to the use of which the inhabitants of such Municipality or Corporate Town have acquired or may hereafter acquire a common right.

(*c*) Any person lawfully occupying or holding land in accordance with the provisions of any agreement, made before or after the taking effect of this Act, empowering the Government to allot lands upon the promise of title, subject to the fulfilment by the allottee of prescribed conditions.

It should be noted that the Government is not amenable to the fencing laws in respect of boundary fences between Crown land and privately owned land and between native reserves and privately owned land, nor is it legally bound to contribute towards the cost of erecting fencing along declared roads passing through privately owned land.

The Government has, however, accepted a limited amount of financial responsibility for the cost of erecting the three above-mentioned types of boundary fences. In other words, sums of money are voted annually in the Votes of the Department of Lands, the Native Department and the Department of Mines and Works, from which claims in respect of boundary and road fences can be met, but only up to the amount voted annually for this purpose.

Applicants desiring Government assistance towards the cost of fencing boundaries between Crown lands and their farms should therefore apply to the Department of Lands, and those desiring to fence between their farms and native reserves, to the Chief Native Commissioner. The Department of Mines and Works should be approached for a contribution towards the cost of fencing along declared roads.

SPECIMEN LETTERS.

A.—Letter calling upon a neighbour to join in the cost of a fence.

Dear Sir,—

I beg to inform you that I propose to erect a dividing fence on the border of this farm and that of...................... and call upon you, in terms of section 6 of the "Fencing Ordinance, 1904," to contribute towards the cost thereof. The line concerned runs from......................to......................

I propose the erection of.................*(here state kind of fence to be erected, material, cost, etc.)* and that................. *(here state proposals for erection, by what means, cost, etc.)*

Yours faithfully,

B.—Letter calling upon a neighbour to go to arbitration.

Dear Sir,—

With reference to my letter of...................(see A) in view of our failure to arrive at an agreement with regard to ....*(here state points on which no agreement arrived at)*, I now propose that the matter should be settled by arbitration in terms of clause 7 of the "Fencing Ordinance, 1904," and have nominated Mr............................to act as arbitrator on my behalf. Will you please nominate an arbitrator to act for you?

Yours faithfully,

C1.—Letter acknowledging A and agreeing to share expenses.

Dear Sir,—

I have your letter of..................regarding the erection of a joint fence, and in reply beg to state that I am prepared to agree to the terms suggested and to pay half cost of all expenses (*or any other proposals as the case may require.*)

Yours faithfully,

C2.—Letter acknowledging A and requesting to pay by instalments.

Dear Sir,—

I have your letter of.................regarding the erection of a joint fence. In reply, I beg to state that I am prepared to agree to the fence suggested, but wish to avail myself of the provisions of section 9 of the "Fencing Ordinance, 1904," and to pay the amount of my share of the cost by instalments, with interest at the rate of 6 per cent. per annum, extending over a period of.................years.

Yours faithfully,

(See in reply specimen *F.*)

D.—Notice in Gazette *and Newspaper calling on owner whose address is unknown to contribute.*

To A.B., owner of farm............................., situated in the District of.........................

Take notice that I intend to fence my farm................ and in terms of sections 5 and 11 of the "Fencing Ordinance, 1904," I hereby call upon you to contribute towards the cost of construction of the fencing of our common boundaries from.........................to.........................

(Sgd.) C.D.

E.—Letter calling on neighbour to assist in repairing a boundary fence.

Dear Sir,—

I beg to inform you that the boundary fence dividing our farms....................and....................is out of repair (*here state nature and extent of damage*). I therefore beg to call upon you to assist in repairing the same in terms of section 15 of the "Fencing Ordinance, 1904."

Yours faithfully,

F.—Letter calling upon neighbour to pass Mortgage Bond.

Dear Sir,—

I beg to acknowledge your letter of......................(see specimen C) and note that you wish to pay your share of the cost of our joint fence by instalments. I am agreeable to this, provided you pass a mortgage bond over your farm in terms of section 29 of the "Fencing Ordinance, 1904" (*or other security can be arranged by mutual agreement*).

Yours faithfully,

G.—Letter to Registrar of Deeds notifying debt owing by neighbour for fencing.

Sir,—

In terms of section 30 of the "Fencing Ordinance, 1904," I beg to notify you of the undermentioned debt incurred in connection with a joint boundary fence between the farms ....and............ ...., and to request you to register the same in the Register of Deeds.

Name of farm.................. ....

Amount owing ....

Situation and name of property in respect of which Bond has been demanded............................

Date of the grant or transfer of the said property to the said person..............................

The above amount has been agreed upon, *or* ascertained according to law, and the person above named has been duly called upon to pass a mortgage bond and has failed to do so.

I am,

Your obedient servant,

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 36. November, 1935.

Swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) have been reported from the following districts during the month, namely: Charter, Hartley, Nyamandhlovu, Makoni, Bikita, Melsetter, Victoria, Umtali, Gwanda, Bulawayo, Ndanga, Bulalima-Mungwe, Matobo, Chibi and Darwin. Most of the swarms have been described as large, some as "exceptionally large."

In conformity with previous experience the relatively humid Melsetter district on the eastern border has been haunted by numerous swarms crossing to and from Portuguese East Africa.

Considerable damage to young grass and early grain is reported.

No reports have been received of egg-laying, which commenced during the last week of November last year. Specimens forwarded to Salisbury had not shown full development of ovaries by the end of the month and the breeding coloration of the insects has not as yet become very marked.

No disease or parasite attack has as yet been demonstrated, but storks and hawks have been reported attacking the swarms in various parts of the Colony. The white stork (*Ciconia alba*) has apparently been more in evidence than for some years past.

The lack of general rains during November may be regarded as favourable to the locusts, which may lay eggs before disease brings about a marked reduction in numbers.

At the same time, the number of locusts in the Colony amounts to only a small fraction of the number present at the end of November last year.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

OCTOBER, 1935.

AFRICAN COAST FEVER.

No cases occurred at any of the infected centres. The slaughter of the infected herd on Doune Farm, Salisbury District, was completed.

FOOT AND MOUTH DISEASE.

No cases in the Colony.

TUBERCULIN TEST.

Ten bulls and seventeen heifers were tested upon importation with negative results.

MALLEIN TEST.

Twelve horses and fourteen donkeys were tested upon entry; no reactions.

IMPORTATIONS.

From the Union of South Africa.—Bulls 10, heifers 17, horses 10, sheep 688.

From the Bechuanaland Protectorate.—Sheep 135, goats 100.

From the United Kingdom.—Horses 2.

EXPORTATIONS.

To the Union of South Africa.—Horses 4, donkeys 14. For local consumption:, Oxen 87, cows 94.

To Northern Rhodesia.—Sheep 127.

EXPORTATIONS.—MISCELLANEOUS.

Chilled beef quarters, 7,544; frozen boned beef quarters, 13,464; tongues, 21,890 lbs.; livers, 20,658 lbs.; hearts, 11,417 lbs.; tails, 3,747 lbs.; skirts, 4,883 lbs.; shanks, 36,875 lbs.; kidneys, 3,503 lbs.

Meat Products.—From Liebig's Factory: Beef fat, 35,000 lbs.; corned beef, 86,400 lbs.; tongues, 2,160 lbs.; meat meal, 72,000 lbs.

From Rhodesian Export & Cold Storage Co., Ltd.—Cow tail hair, 500 lbs.; bacon, 2,609 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

NOVEMBER, 1935.

Barometric Pressure.—The mean monthly pressures averaged about one millibar above the normal values.

Temperature.—The daily mean temperatures averaged from 2° to 3° below normal, the hottest period being from the 15th to the 17th of the month.

Rainfall.—The rainfall for the month was considerably below normal, the greatest deficiencies being in the South and Midlands and the N.E. of the country. The development of the equatorial low was very weak, and the only occasion on which it extended into Southern Rhodesia was on 22nd to 24th, when fairly good rains fell in parts, but the low withdrew before general rains could set in. Previous to this only scattered showers and a few thunderstorms had fallen.

NOVEMBER, 1935.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	103	55	88.2	63.7	76.0	79.7	74.6	63.6	54	57	..	0.53	1.84	3	...
Beit Bridge	965.3	...	110	57	90.7	67.4	79.1	...	76.8	63.3	49	54	3.5	0.00	2 14	...	1,500
Bindura...	892.1	...	95	57	84.8	63.0	73.9	...	72.4	62.1	57	56	2 5	0.99	2 93	6	3,700
Bulawayo	869.1	868.1	95	51	83.7	58.6	71.1	72 6	70 6	57.7	48	48	4.8	0.32	3 29	6	4,426
Chipinga	894.0	...	93	48	76.4	56.4	66.4	...	66.8	60.1	71	57	5.7	2.01	4.18	9	3,685
Enkeldoorn	858.6	...	92	50	80.2	57.2	68.7	72.0	67.8	57.9	57	51	4.1	1.29	3.37	4	4,788
Fort Victoria	896.3	894.9	99	50	83.0	58.8	70.9	72.7	71.4	59.1	51	50	3.6	0 17	2.89	2	3,571
Gwaai Siding	904.7	...	101	55	91 6	62.1	76.9	...	76.4	62.9	48	54	3.9	1.95	2.29	5	3,278
Gwanda	907.1	...	101	54	85.3	62.5	73.9	...	71.1	58.8	50	50	5.0	0.69	2.16	5	3,229
Gwelo	863.1	...	95	49	83.3	58.0	70.7	73.6	70.1	57.9	50	49	4.0	0.54	3.66	4	4,629
Hartley	886.0	...	96	53	85 7	61.0	73.4	76.4	73.2	60.8	50	53	4.2	0.70	3.53	4	3,879
Inyanga	837.6	...	86	46	76.7	54 0	65.4	...	68.2	57.6	53	50	1.7	3.73	3.74	5	5,514
Marandellas	838.8	...	88	49	77.7	55.1	66 4	..	66.9	57.0	56	50	4.4	2.20	3.89	6	5,453
Miami	879.3	...	92	56	82.5	61.7	72 1	...	72.3	62.2	59	56	4.9	2.20	2.33	7	4,090
Mount Darwin ...	908 1	...	98	52	87.7	63.2	75.4	..	74.9	63.4	54	56	3.1	0.47	3.28	3	3,179
Mount Nuza	802.8	...	81	43	64.6	49.6	57.1	...	56 9	52.4	78	48	6.6	7.08	0.00	13	6,668
Mtoko	878.1	...	94	53	82.9	61.1	72.3	...	72.9	62.3	56	56	2.8	0.44	3.31	4	4,141
New Year's Gift...	...	...	102	52	83.8	59.5	71.6	...	71.2	62.5	61	57	...	0.59	3.03	6	2,690
Nuanetsi	962.3	...	109	54	90.9	62.8	76.9	...	77 6	65.7	55	58	3 4	0.13	2 13	1	1,581
Plumtree	864 8	...	96	52	83.9	61.1	72.5	..	71.6	57.3	43	46	2.7	0.74	2.82	4	4,549
Que Que	882 6	...	96	53	86.3	60.7	73.5	...	72 4	59.5	48	50	5.4	0.32	2.66	2	3,999
Rusape...	863 2	...	93	47	79.8	56.2	68 0	..	67 5	58.3	60	52	3.4	2.44	4 66	6	4,648
Salisbury	855.4	854.5	91	49	81.6	58 0	69.8	71.9	71.1	59.5	51	52	4.7	2.86	3 55	8	4,885
Shabani	908.0	...	101	54	85.1	61.6	73.4	...	72.2	60.3	52	52	5.3	0.23	1.55	3	3,193
Sinoia	888.7	...	95	52	86.1	61.2	73.7	...	73.8	61.8	52	54	3.5	2 13	3.31	5	3,795
Sipolilo	885.6	...	93	56	83.4	62.9	73.2	...	73 5	61.7	53	54	2.9	2.57	3 26	5	3,876
Stapleford...	843.2	...	86	37	71.1	49.9	60.5	...	62.9	57.9	80	54	6.0	7.33	5.97	13	5,304
Umtali...	894.1	892.9	99	50	82.3	57.7	70 0	72.6	69 5	61.4	65	57	5.7	3.63	3.77	10	3,672
Victoria Falls ...	914.0	...	104	62	93.4	68.5	81.0	...	77.3	65.8	57	59	2 3	2.69	2.59	7	2,990
Wankie	926.7	...	104	64	95.4	72.3	83.6	..	81.5	65.9	45	57	4.4	1.18	1.94	5	2,567

Rainfall in October, 1935, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	N n
1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...	4	5	6	2	6	3	30	
2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	18	...	10	8	...	1	...	42	
3	...	...	...	4	...	...	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	11	46	...	...	79	...	...	...	142	
4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2	5	3	2	3	16	
5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	8	7	17	
6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	25	1	9	37	
7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	1	7	3	...	...	13	
8	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	12	...	...	...	...	...	2	...	4	...	19	
9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9	...	...	...	...	1	...	19	9	38	
10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	2	...	...	...	...	...	...	...	...	...	3	
Mean	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	3	1	3	4	4	6	4	28	

Rainfall in November, 1935, in Hundredths of an Inch. Telegraphic Reports.

rea	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total	Nor-mal
1	8	...	...	...	...	...	...	2	16	..	...	...	...	...	...	...	3	...	...	..	...	4	8	9	..	...	15	...	...	...	65	276
2	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	2	...	...	...	...	4	6	72	1	...	...	...	...	...	87	266
3	...	...	...	...	3	...	...	5	9	3	...	...	...	...	...	1	6	...	...	...	...	67	..	86	2	...	9	1	...	...	192	449
4	...	...	...	...	...	..	...	2	16	...	...	...	...	..	...	...	1	...	...	...	...	25	15	26	1	...	1	...	...	...	87	341
5	12	1	...	...	...	...	...	13	9	...	..	..	...	...	...	...	...	..	...	3	5	28	32	9	...	...	42	...	...	...	154	245
6	...	...	...	...	...	11	3	5	2	...	...	...	...	...	...	...	2	...	1	...	...	78	3	17	...	3	18	...	...	...	143	355
7	...	...	...	...	1	1	2	9	6	22	9	...	...	...	...	...	5	...	...	...	...	63	52	78	4	10	19	...	...	...	281	429
8	2	...	...	...	...	3	1	15	...	...	1	...	...	...	...	...	17	...	...	...	...	69	33	49	1	9	6	...	...	...	206	363
9	...	...	...	...	...	1	...	...	...	...	...	...	..	...	...	...	29	...	...	...	...	83	29	36	18	2	10	...	...	...	208	311
0	...	...	...	...	...	...	...	...	...	6	...	...	...	...	...	...	...	...	...	...	...	16	6	18	...	...	...	...	...	...	46	329
ean	4	...	...	...	...	2	1	5	7	2	1	...	...	...	...	...	6	...	...	...	1	38	19	32	3	2	16	...	...	...	139	311

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 568. The Treatment of Arable Lands, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.

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No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwtring, Agriculturist.

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 762.—The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 837. Veld Grass Silage—A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.

No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulip Poisoning of Cattle, by Sydney M. Stent, Senior Botanist. and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.

No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.

No. 878. A.I.V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.

No. 901. Some Notes from the Cotton Station, Gatooma, by J. E. Peat, B.Sc. (Edin.), A.I.C.T.A. (Trinidad).

No. 932. Further Notes from Cotton Station, Gatooma, by J. E. Peat, Empire Cotton Growing Corporation.

No. 929. A Promising Fodder Plant, by H. C. Arnold, Manager, Salisbury Experiment Station.

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No. 740. Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon, Poultry Expert.

No. 761. Housing and Feeding of Adult Stock, by H. G. Wheeldon, Poultry Expert.

No. 795. The Turkey, by G. H. Cooper, Assistant Poultry Officer.

No. 803. Geese, by G. H. Cooper, Assistant Poultry Officer.

No. 827. The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.

No. 865. Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Chief Poultry Officer.

No. 870. Trap Nests, by B. G. Gundry, A.I.Mech.E. (combined with No. 875).

No. 872. The Poultry Industry: Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.

No. 875. Another Trap Nest, by B. G. Gundry, A.I.Mech.E. (combined with No. 870).

No. 884. The Vitamins in Poultry Feeding, by G. H. Cooper, Poultry Officer, Matopo School of Agriculture and Experiment Station.

No. 918. The Moulting of Poultry: The Normal and Pullet Moult, by H. G. Wheeldon, Poultry Officer.

No. 933. Ducks on the Farm (Revised), by H. G. Wheeldon, Poultry Officer.

No. 939. The Use of Galvanised Iron in the Making of Some Appliances for Poultry Keeping, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.

No. 940. A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station .

No. 947. Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.

No. 965. Egg Marketing Bill: Draft of a Bill having for its purpose the more orderly Marketing of Eggs.

No. 971. Feeds for Poultry and How to Use Them, by G. H. Cooper, Assistant Poultry Officer.

The following pamphlets can be obtained from the Poultry Expert upon application:—

Selecting Birds for Laying Tests, by A. Little, Poultry Expert.
Tuberculosis, by A. Little, Poultry Expert.
Prevention of Disease among Poultry, by A. Little, Poultry Expert.
Preparing Birds for Show, by A. Little, Poultry Expert.
The Fowl Tick (Argas persicus), by A. Little Poultry Expert.
Culling: A Seasonal Operation, by A. Little, Poultry Expert.
Choosing a Male Bird, by A. Little, Poultry Expert.
The Breeding Stock, by A. Little, Poultry Expert.
Diseases of the Digestive System, by A. Little, Poultry Expert.
Mating for Improvement and Increased Egg Production, by A Little, Poultry Expert.
Partial Moult: Broodiness: Selection of Layers of Large Eggs, by A. Little, Poultry Expert.
Exhibiting Eggs at Shows, by A. Little, Poultry Expert.
Condition of Birds on Show, by A. Little, Poultry Expert.
Green Food: The Result of not Supplying Sufficient to Poultry, by A. Little, Poultry Expert.
Good and Bad Hatching Eggs, by A. Little, Poultry Expert.
Grading Fowls, by A. Little, Poultry Expert.
Housing: Three Important Essentials, by A. Little, Poultry Expert.
Advice to Prospective Poultry Farmers, by A. Little, Poultry Expert.
Seasonal Hints—August, by A. Little, Poultry Expert.

Successful Chick Rearing, by H. G. Wheeldon, Assistant Poultry Expert.

Hints to Breeders, October, by A. Little, Poultry Expert.

Abnormalities in Eggs, by A. Little, Poultry Expert.

Hints to Breeders. Prepare for the Breeding Season, by A. Little

Respiratory Diseases, by A. Little, Poultry Expert.

Selection and Preparation of Fowls for Exhibition, by H. G Wheeldon, Poultry Expert.

The Close of the Hatching Season and After, by H. G Wheeldon, Poultry Expert.

METEOROLOGICAL.

No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.

No 532. The Short Period Forecast and Daily Weather Report, by C. L Robertson, B.Sc., A.M.I.C.E.

No 542 Review of the Abnormal Rainfall Season 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E.

No 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc (Eng.).

No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.

No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.

No. 948. The Weather, contributed by The Meteorological Office.

AGRICULTURAL BUILDINGS.

No. 554. Pisé-de-Terre, by P. B Aird.

No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.

No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.

No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.

No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.

No. 863. Piggeries, by B. G. Gundry, A.I.Mech.E.

No. 889. The Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.

No. 902. Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E.

No. 908. A Charcoal Safe or Cooler, by B. G. Gundry, A.I.Mech.E., Irrigation Divisiion.

No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by B. G. Gundry, A.I.Mech.E.,

No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.,

No. 941. A New Type of Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.

MISCELLANEOUS.

THE RHODESIA
Agricultural Journal

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

PUBLISHED MONTHLY.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, *Salisbury.*

Report of the Dairy and Pig Industries Committee.—In July last the Hon. the Minister of Agriculture and Lands appointed a Committee to enquire into and report upon the dairy and pig industries in Southern Rhodesia. The Committee consisted of W. P. Currie, Esq. (Chairman), J. Campbell, Esq., K. M. Goodenough, Esq., E. R. Jacklin, Esq., A. P. Shone, Esq., and F. Gillwald, Esq. (Secretary).

The report has now been published and contains a great deal of very special interest to the farming community of this Colony.

The report states that evidence given by individual farmers was practically unanimously in favour of full co-operation of the dairy industry in the interests of pro-

ducers, and the Committee recommends that the industry should be brought under further control, the ultimate objective being complete control and co-operation resulting in the acquisition by the producers of the factories connected with the industry. The Committee also recommends that only five creameries should be retained—at Salisbury, Bulawayo, Gwelo, Fort Victoria and Umtali.

The Committee concluded that the future of the dairy and pig industries rests principally in the hands of the producers themselves. Whilst fully appreciating the many handicaps that producers have to contend with in a young country like Southern Rhodesia, where climatic conditions and other factors present so many difficulties, the Committee felt that the methods employed by many producers leave much to be desired. The overseas market is a highly discriminating one, and producers who hope to enter the export trade must be prepared to bring their methods of production into line with those adopted by countries with which they will have to compete.

Other Dominions have had problems to contend with similar to those confronting Southern Rhodesia and have surmounted these difficulties. There is no reason whatever why Southern Rhodesia should not do the same, but the difficulties can only be overcome by long and sustained effort and the realisation by the producer that only the best is good enough. The attitude, so apparent in many directions, that quantity, not quality, is the end to be aimed at is fatal.

As regards the local market, the public of Southern Rhodesia are entitled to be supplied with products produced under hygenic conditions, and this cannot be said to be the case to a considerable extent at present.

Regarding the pig industry, the Committee considers that it is necessary that a Pig Industry Control Board should be established on the lines of the Dairy Industry Control Board. The functions of the Board would be to formulate and administer the policy necessary to place the industry on a stable basis, to fix prices, organise export and, in particular, to collect and administer the levy fund it is proposed to create in connection with the export of frozen carcases.

Vi-Vi (*Leucæna glauca*). **A Warning.**—Some years ago seed of the small tree *Leucæna glauca*, known as Vi-Vi, was obtained from the Queensland Department of Agriculture, where it was looked upon as a very valuable fodder plant. It grew remarkably well on the Salisbury Experiment Station and a large amount has since been distributed to farmers. It is extremely attractive to cattle and not only are the leaves browsed but even the stems up to the thickness of half an inch or so were eaten. Several farmers contemplated planting Vi-Vi around their paddocks, on contour ridges, etc., as it is known to be highly nutritious.

It is very disquieting to find now that the desirability of this shrub as a feed for livestock is questioned in several parts of the world. The following passages from *Herbage Abstracts* are published as a warning, and it is recommended that until more information is obtained it should be fed in small quantities if at all to cows and sows, but as far as is known there is no objection to its use for working oxen or fattening bullocks. The Department is in communication with the Queensland Department, and with the Editor of *Herbage Abstracts*, and any further information obtained will be published immediately in this *Journal*.

(*a*) "Referring to an article by Rigotard (*Herb. Abst.* 2, 249, 1932) in which *Leucæna glauca* is recommended as a forage plant, the author draws attention to the curious effect which this plant has upon certain animals, whose hair falls out when they are fed with it. Cattle, sheep and goats are unaffected, whereas horses lose the hair of mane and tail, and pigs also lose their hair. There is no apparent injury to the animals' general health, and when the ration of *Leucæna glauca* is stopped the hair regrows, although it is not the same colour and texture as that previously lost. The findings of several authors are quoted. F. Heim de Balsac (Soc. Franc. Agric. colon. 1903) believed the active principle to be an alkaloid contained in the leaves, and found that horses might become very ill from a single meal composed entirely of *Leucæna* leaves, whilst exclusive feeding on the plant was fatal to rabbits."

(*b*) This plant, formerly known as *Acacia leucocephala*, is a native of South America, but is found to-day in many parts of the world, generally as a cover crop for coffee. Its deplitary action on monogastric animals has already been noted (see *Herb. Abst.* 3, 234, 1933). It is noted, however, that ruminants can eat it with impunity. It has been observed to result in sterility in dairy cows and in sows. An analysis of the chemical composition of the grain is given, which shows that in nutritive value it is as good as maize and some other grain."

Advice on Tobacco Diseases.—The Senior Plant Pathologist, Dr. Hopkins, wishes to make known that, although he has now taken up residence at the Tobacco Research Station, Trelawney, the plant pathology laboratory remains in Salisbury, and all enquiries regarding plant diseases should be addressed to that office.

Diseased plant material, tobacco in particular, should not be sent to the Research Station, and any parcels received will be re-directed to Salisbury.

It is obviously undesirable to make the Research Station a centre for the reception ot diseased tobacco from all over the Colony. Furthermore, the duties of the Senior Plant Pathologist do not allow of his dealing with routine advisory work at Trelawney.

Seed Wheat.—Wheat growers are advised to give early consideration to their requirements of seed wheat. Only a limited quantity of good seed is available, and to ensure the purchase of seed of reliable varieties growers should obtain their supplies early.

Asparagus Cultivation.—A short note by Mr. A. N. Rawes (J. Roy. Hort. Soc., Oct., 1935) gives some very useful information about the cropping of asparagus. Several series of beds containing all male plants were compared with beds

planted with female crowns. The result showed that in every case the male plants yielded about 60 per cent. more saleable stems than the females. The series covered a variety of planting methods and differing culti ion, but the superiority of the males was obvious in every c . Very little difference in the relative grades of produce w however, demonstrable between the two sexes. The paper reports a continuation of previous experiments made at the Wisely gardens, with confirmation of the earlier results, and also discusses the merits of close and wide planting.

Witchweed Control.—Maize farmers are beginning to realise that the substitution of trap-crops such as amber cane, white Kaffir corn and Sudan grass for the normal green-manure crops in the rotation is the most rapid, effective and cheapest method of controlling witchweed, where the infestation is severe. The following figures demonstrate this:—

Year.		Acreage under Trap-crops.
1932/33	...	1,445
1933/34		1,796
1934/35		2,208

Although a steady rise in the acreage placed under "traps" is shown by these figures, it is feared that the practice received a regrettable check owing to the ill-effects on the following maize crops noted in a few cases, which was due to the traps having been allowed to mature beyond the limit of two months from germination advised by this Department before they were ploughed in. The explanation of such ill-effects was given in an article on witchweed control, which appeared in the November, 1935, issue of this *Journal.*

It is considered desirable to call attention to this matter again in order that the same error should not be repeated by others.

Trap crops must be ploughed under within two months from germination, *no matter what the stage of growth of the witchweed,* in order to avoid the nitrogen robbery from the soil by the decomposition bacteria, which results from the ploughing in of large quantities of organic matter having too low a content of nitrogen.

Legumes and Nitrogen.—The following query received from a Concession farmer, and the reply sent by the Assistant Agriculturist, are published for general information.

Query.—"I will be much obliged if you could send me a few notes on *Nodule bacteria.* My chief question is the significance of the nodule; does it denote that nitrogen has been fixed in the soil or is the nitrogen present in the nodule and becomes absorbed in the soil when the root rots away?"

Reply.—In reply to your query *re* the legume nodule bacteria. These bacteria enter the roots through the root hairs, and cause the tissues of the roots to swell out to form the characteristic nodules. In these nodules the bacteria live and extract nitrogen from the air in the soil. The bacteria use part of this nitrogen for building up their own tissues, part is passed through the sap stream to the plant and is used by it for the growth of its tissues both above and below ground. It appears also, from the latest research at Rothamsted, and in the U.S.A., that some of the nitrogen fixed by the bacteria diffuses from the nodules or roots of the growing legume into the soil, for it has been proved that where mixed crops of legumes and grasses (such as lucerne and rye grass) are grown the grass always contains much more nitrogen than is applied to the soil as fertiliser. The same has been shown to take place where oats and tares are grown together in nitrogen-free soil.

From the above you will see that the nitrogen fixed from the air by the nodule bacteria is stored (1) in the tissues of the host plant both above and below ground, (2) in the bodies of the bacteria themselves inside the nodules, (3) in the soil (that portion excreted from the roots or nodules).

Now, soon after the legume flowers the nodules fall off from the roots and much of the nitrogen in their body protein is converted into the soluble nitrate form and is thus available to plants, so that if the legumes were pulled from the soil before flowering and it were possible to remove all roots and nodules, the soil would only gain by the amount of nitrogen excreted by the legume or nodules, if any. I say "if any," since it has not been proved that nitrogen is excreted into the soil in the absence of a companion crop.

If the legume is pulled after flowering, the soil would gain the excreted portion of nitrogen and also that contained in the nodules, which had become detached from the roots.

The greater proportion of the nitrogen present in a leguminous plant is contained in the top-growth, and a much smaller proportion in the roots and nodules.

To retain all the nitrogen fixed by the nodule bacteria in the soil, the whole leguminous crop should be ploughed under. However, in field practice in this country it is found that if the top-growth of a sunnhemp crop is removed from the soil the loss of yield in a succeeding maize crop is about 6 per cent. or 1.23 bags per acre where the level of yield of the maize is between 16 and 18 bags per acre. Under ordinary farm conditions the loss is probably less than a bag per acre. In the case of velvet beans and dolichos beans the loss is approximately double. Recent research carried out in Nigeria has shown that an even smaller loss of yield in the following maize crop results from the removal of the top growth of leguminous crops. I know of very little research on this point having been carried out in temperate climates, but judging by the failure of green manuring with tares for a winter wheat crop in the Woburn experiments, and the far heavier yields of kale after the whole of a lupin green manure crop was ploughed under as compared with the yield after a lupin stubble only (the former yield was more than double the latter), it seems probable that results under temperate conditions would be very different from those obtained here and in Nigeria.

Other points of great interest and considerable practical importance which have recently been revealed by the research of Thornton and his collaborators at Rothamsted, and which I think may interest you and your neighbours, are the following.

During the life cycle of the bacteria they pass through a mobile stage when they can swim in the soil moisture, and it is only during this mobile stage that the root hairs of legumes are infested by them. Their rate of travel in the heavy Rothamsted clay soil is about 1 inch in 24 hours.

It was also found that the addition of minute quantities of acid calcium phosphate to the soil along with the bacteria hastens the production of this mobile stage, and also the rate of migration through the soil. This is the reason why those farmers growing soya beans have been advised by this Department to add a small proportion of acid calcium phosphate to the mixture of the bacterial culture and skim milk used in inoculating the soya bean seed before sowing, following the method developed at Rothamsted. Its practical importance will be realised when it is known that the addition of acid calcium phosphate to the inoculating fluid was proved to approximately double the number of nodules that were produced.

It has also been shown that actual penetration of the root hairs by the bacteria must always be preceded by a deformation or "kinking" of the root hairs, which is caused by a secretion from the bacteria. It has been further proved by this remarkable research at Rothamsted that the presence in the soil of more than a certain percentage of nitrate or ammonia salts inhibits this "kinking" of the root hairs, and thus prevents their infection and the development of nodules. This explains why soya beans may show poor nodule development in our soils despite proper inoculation of the seed, when they have been sown in soil green manured the previous season, and therefore rich in nitrate.

Not only does the presence of an excess of nitrate in the soil prevent the infection of legume root hairs, but it also slows down or entirely stops the growth of the nodules.

A further point of interest rather than practical importance proved recently at Rothamsted is that the seedling legume secretes some substance which stimulates the growth of the bacteria in the soil.

The following is a brief list of leguminous crops which are commonly grown in Rhodesia:—Sunnhemp, cowpeas, Kaffir beans, velvet beans, dolichos beans, soya beans, haricot beans, peas, lucerne.

Department of Agriculture and Lands.

NOTICE TO FARMERS.

All farmers requiring advice on soil conservation, irrigation, or water conservation schemes, are requested to forward their names and full particulars of the work required to the Chief Engineer, Irrigation Division, P.O. Box 387, Salisbury, or, if in Matabeleland, to the Irrigation Engineer (Matabeleland), P.O. Box 566, Bulawayo, as soon as possible.

Applications should show the name of the farm, the type and approximate amount of work required to be set out, and the month during which the visit would be most suitable.

There is no charge for this advice, except where special visits have to be made.

The co-operation of farmers is requested in order to avoid, as far as possible, omissions of visits or delays of Engineers on tour.

H. G. MUNDY,
Secretary,
Department of Agriculture and Lands.

Notes on the Feeding of Dairy Cows

DURING THE SUMMER MONTHS.

By A. E. Romyn, Chief Animal Husbandry Officer.

There is a general demand for a schedule giving the amount of concentrates which should be fed to dairy cows during the summer months.

Under our conditions this is not a simple request to meet. Practical information is scanty and the data on the composition of the different pastures in the Colony is too incomplete to work out reliable rations on a theoretic basis.

The procedure followed in these notes has therefore been to use practical experience where it is available and to make calculations based on a reasonable assumption of the composition of the grass at different times of the year in other cases. The results, as far as they have been tried out, have answered in practice.

The feeding value of the grazing will vary from farm to farm and, on the same farm, it will vary with the rainfall, the time of the year and the method of veld management. A general assumption has therefore been made of the effect of these factors in drawing up the feeding table which follows.

The figures given are intended as a general guide. On good grazing farms, or where the method of veld management is above the average, the quantities may be decreased. Under less favourable conditions they should be increased. In abnormal years the ordinary seasonal variation in the feeding value of the grass, which generally decreases progressively from about December to May, may be altogether upset. Obvious allowances must be made for variations of this nature in applying the recommendations made.

Cows on good summer pasture with ample shade and water.

In actual practice, however, any dairy farmer who has not the past experience to fit his conditions would not usually go far wrong in starting on the scales recommended, and later, by keeping milk records, modifying, if necessary, the scale of feeding recommended to suit the market returns obtained.

The recommendations given do not meet conditions obtaining in some "low veld" areas of the southern portion of the Colony, where the winter grazing is better than the summer pastures, or where the cows are grazing on established pastures. On good established pastures for eight or nine months of the year it is often economic to dispense with grain feeding altogether for cows of medium production.

Concentrate Rations.—Four typical concentrate rations have been used in making up these notes. These rations should meet most of the requirements of the average dairy farm in this Colony:—

Ration (1)—Maize meal alone.

Ration (2)—Maize meal 200 lbs.
Bean meal 100 lbs. (cowpeas, dolichos beans, etc.).

Ration (3)—Maize meal 300 lbs.
Groundnut cake 100 lbs.

Ration (4)—Maize meal 300 lbs.
Bean meal 100 lbs.
Groundnut cake 100 lbs.

In all these rations 2 lbs. salt per 100 lbs. of grain used should be added. The value of bonemeal has not yet been generally established in the Colony, but it is usually considered advisable to add 2 lbs. bonemeal as well.

It is advisable, where possible, to replace part, say, one-third by weight, of the maize meal by some bulky semi-concentrate such as bran or sunflower head meal. Rations (1) and (2) will benefit especially by such an addition. Part or all of the groundnut cake can be replaced by meat meal or blood meal. The same quantity of meat meal should be used as groundnut cake, but only half the amount of blood meal is needed.

Groundnut feed ("monkey nut meal") made by grinding up whole nuts in the shells can replace groundnut cake in the proportion of 2 parts of groundnut feed to 1 part of cake by weight. Not more than 3 lbs. to 4 lbs. of groundnut feed per day is, however, generally recommended on account of the high oil content. Cotton seed, if not used in excess, will replace groundnut cake in the same proportions as groundnut feed.

Concentrate Rations for Dairy Cows on Grass.

*Time of year.	Production of cows in galls. per day.	Amount of concentrates recommended under ordinary conditions—lbs. per day. (Figures in brackets refer to the number of the rations.)
November	1	No concentrates.
December	2	2 lbs. maize meal.
January	3	5 lbs. of rations (2), (3) or (4)
	4	8 lbs. of rations (3) or (4)
February	1	1 lb. maize meal.
and	2	4 lbs. rations (2), (3) or (4)
March	3	8 lbs. rations (3) or (4)
	4	11 lbs. rations (3) or (4)
April	1	3 lbs. ration (2)
and	2	6 lbs. rations (3) or (4)
May...	3	9 lbs. rations (3) or (4)
	4	12 lbs. rations (3) or (4)
June onwards		Usually necessary to feed as for winter production, crediting the grazing with very little or no productive value.

*These divisions are approximate and depend on the seasonal rainfall.

Rations (3) or (4) could be used throughout if desired, but are unnecessarily high in protein in some cases.

As the grazing matures after April or May it is important that some succulent feed for the cows should be provided in addition to the concentrates given, and provision for a certain amount of green feed at this time of the year should always be made. Suitable feeds for this purpose are any kind of silage, sweet potato tops, sweet potatoes, green mealies, or any pasture or small grain crop grown under irrigation.

It is important to maintain the condition of the cows at the end of the grazing season. Care should be taken that no large drop in production is allowed just before the winter commences. On this account it is unwise to postpone any increase in the grain ration until the cows show an obvious dropping off in milk yield or condition, as ground lost at this time of the year will not be recovered that winter.

Where the cows are suckling calves, milking should be discontinued and the cows turned out with their calves. Any of these cows which are in low condition should be fed sufficient silage and hay to ensure that the calf is not starved during the winter months.

Annual Report of the Agriculturist.

FOR THE YEAR 1934.

By D. J. McLoughlin, Agriculturist.

Season and Crops.—The season opened very propitiously. The rainfall for the month of November established a new record and exceeded the previous highest record in 1900 by 0.12 inches with a total fall of 6.25 inches.

The precipitation in December was much more patchy, but planting conditions on the whole were very favourable with spells of wet weather alternating with fine weather. The approximate total for the month amounted to 4.3 inches, or about 1.3 inches below normal. The total rainfall, 1st October to December, amounted to 10.8 inches compared with a normal of 9.9 inches. The short rainfall in December was largely counter-balanced by the excessive total precipitation in November, which permitted of the land being well worked and brought to a good tilth for early planting in December.

January recorded an approximate total of 5.3 inches only compared with the normal 7.1 inches, while the rainfall for February, amounting to 3.7 inches, was about 1.9 inches below the average. The 3 inches recorded in March was 1.1 inches below the average for that month.

The total rainfall since 1st October was 22.8 inches, making a deficiency of 3.8 inches for the season up to the end of March.

Although the total rainfall for the season was below normal, its distribution in the northern maize belt was favourable for most crops. The Salisbury district was again

fortunate and recorded a more or less normal season. In the southern areas conditions were less favourable for crop production.

Maize.—A feature of the year as regards this staple crop was the export overseas of over 300,000 bags. Owing to the short crop of maize in the previous year none was exported overseas in 1933, although 250,000 bags were exported to the Union of South Africa, and the export of the Colony's surplus maize this year to the United Kingdom markets should maintain the favourable connections established.

The season's European production was 1,728,065 bags from 246,371 acres, or an average of 7 bags per acre compared with 1,156,321 bags from 251,042 acres, or an average of 4.61 bags per acre for the previous year.

Ground Nuts.—The crop occupied 7,109 acres, which was 288 acres more than the area planted in 1932-33, when the total yield was only 38,006 bags, or 5.6 bags per acre, the lowest yield since 1922. Whereas, in 1933 some 22,423 bags had to be imported into Southern Rhodesia, the crop of 76,020 bags will more than meet the requirements of the Colony.

Efforts by local firms to further develop the overseas export trade for specially selected ground nuts in shell suffered on account of the unremunerative market prices, and it is a matter for regret that a surplus production should have synchronised with such low values.

Sunflowers.—It is pleasing to record the increased attention accorded this crop and that some 12,000 bags were graded for export. The crop for the season was 36,704 bags from 8,150 acres. The previous season's low yield of 2.6 bags from 4,369 acres can be attributed to the fact that in that year the rains ceased rather early and that as a side-line crop sunflowers do not receive sufficient attention and that planting is generally carried out rather late in the season.

Legumes and Green Manuring.—The acreage under various leguminous crops, including ground nuts, has shown considerable expansion during the last six years, although the acreage decreased from 66,629 acres in 1931-32 to 57,551 acres in 1932-33. This expansion is attributed to the more general adoption of green manuring as a rotation for maize. The reduced acreage under legumes in 1932-33 coincided with the reduced acreage under maize occasioned by the lower overseas prices for the latter crop.

The total area under green manure crops, both leguminous and non-leguminous in 1932-33 was 46,513 acres, of which 34,260 acres were in respect of legumes compared with 43,761 acres in 1931-32 and 11,427 acres in 1928-29, while the area planted to non-legumes, principally sunflower and sorghums, was 12,253 acres in 1932-33 as compared with 9,852 acres in 1931-32, and 4,559 acres in 1928-29.

The total area under green manure crops in 1933-34 was 46,130 acres.

Wheat.—The growing of wheat, both under irrigation and on moisture retaining soil, has made very considerable progress during the last three years. Wheat production has been stimulated mainly by improved methods of cultivation, more suitable varieties and assistance afforded by the Government in arranging a guaranteed price payable by the millers in return for certain rebates of duty on imported wheat. During the five years 1928 to 1932, production has increased from 7,000 bags to 42,000 bags.

During the past three years growers have had an assured market at a fixed price, the relative figures being 23s., 22s. 6d. and 22s. 6d. per bag of 200 lbs. nett for fair average quality wheat weighing not less than 62½ lbs. per bushel.

Apart from the question of irrigation, which now accounts for fully 50 per cent. of the total output of wheat, production can still be very largely increased on moisture retaining soils.

This increased production is, however, largely handicapped by the lack of capital available by growers operating on vlei land, for the investment in seed-drills, harvesting machinery and fertiliser. The acreage these farmers can economically operate is limited and the Colony's output of wheat is thereby restricted.

The position of the farmer growing wheat under irrigation is more satisfactory as his crop is much more certain and offers greater security for credit to finance his operations.

The Colony's average yield per acre of wheat under irrigation is deplorably low, the yield in 1933 was only 3.3 bags. The most backward district was Melsetter, which only averaged 2 bags per acre on 1,931 acres under irrigation. Rust is very prevalent in this area, and it would appear that many growers are still sowing most of the older varieties which can to-day not be relied upon as general purpose wheats. Kenya Governor wheat has proved the most rust resistant variety grown in the Colony, including the Umtali and Melsetter areas, and its cultivation is strongly recommended in areas most subject to rust. It is proposed to tour the Melsetter area in June, 1935, to advise on the most successful methods of wheat cultivation.

The practice of green manuring irrigated wheat land in the summer is now generally recognised as an essential rotation for wheat. The practicability of green manuring vlei land very early in summer is still under test, and results indicate that in a normal season the practice should be a success, particularly in seasons when the ground still contains a little moisture after the wheat crop is removed and when germination is aided by very early rains. In other seasons only a partial benefit can be anticipated. A 12-acre field has been sown to Somerset sunnhemp on Rubenvale Farm, Umvuma, and this crop has been sown at the double rate of 40 lbs. per acre to test the effect of heavier sowings.

The 1934 wheat crop has suffered more severely than usual from the attacks of rust, probably owing to the mild winter experienced. The disease was most severe in the Umtali and Melsetter areas, where some crops were entirely destroyed by rust. Further damage by a late frost in the first week of

September, coupled with a shortage of moisture in much of the vlei land under wheat has resulted, and yields in the Charter, Chilimanzi and Gutu areas are considerably down. The wheat crop was 28,594 bags from 16,401 acres.

The following table gives the production of wheat (summer and winter) by principal districts of Southern Rhodesia during the years 1932 and 1933, showing whether irrigated or not irrigated.

(A).—Area.

District.	Not Irrigated. Acres.		Irrigated. Acres.	
	1932.	1933.	1932.	1933.
Victoria and Ndanga	349	491	637	747
Chilimanzi	1,740	1,907	303	527
Mazoe	20	34	713	712
Salisbury...	715	952	156	255
Charter	4,110	4,705	754	784
Gutu	1,242	1,442	36	101
Melsetter...	233	271	1,327	1,951
Umtali	8	26	460	608
Other districts	671	417	579	765
Total...	9,088	10,245	4,965	6,430

(B).—Total Yield (Bags of 200 lbs. net).

District.	Not Irrigated. Bags.		Irrigated. Bags.	
	1932.	1933.	1932.	1933.
Victoria and Ndanga	393	715	2,830	2,796
Chilimanzi	4,394	3,718	1,616	1,866
Mazoe	87	138	4,088	3,096
Salisbury...	1,634	1,105	895	1,226
Charter	8,667	6,045	3,973	4,409
Gutu	2,382	1,610	206	189
Melsetter...	731	100	5,230	3,842
Umtali	20	126	1,998	2,332
Other districts	999	404	1,678	1,758
Total...	19,607	13,961	22,514	21,514

(C).—Yield per Acre.

District.	Not Irrigated. Bags. 1932.	1933.	Irrigated. Bags. 1932.	1933.
Victoria and Ndanga	1.9	1.5	4.4	3.7
Chilimanzi	2.5	2.0	5.3	3.5
Mazoe...	4.3	4.1	5.3	4.3
Salisbury...	2.3	1.2	5.7	4.8
Charter	2.4	1.3	5.3	5.6
Gutu	1.9	1.1	5.6	1.9
Melsetter...	3.1	.4	3.9	2.0
Umtali	2.5	4.8	4.3	3.8
Other districts	1.5	1.0	2.9	2.3
Average...	2.2	1.4	4.5	3.3

Maize Grading and Export.—Staff: Mr. L. C. Roberts was appointed to act as Temporary Senior Grain Inspector, and supervised the grading of the 1933-34 maize crop. He was appointed on the 1st July and relinquished his post at the end of the season on the 20th October, 1934.

The following served as Temporary Grain Inspectors for the periods specified:—

F. Scamell, 11th July to 30th September, 1934.

S. W. Cherry, 24th July to 10th October, 1934.

R. S. Arnott, 1st August to 10th October, 1934.

The Senior Grain Inspector was provided with a lorry as transport, and on occasions one of the other graders accompanied him to expedite the grading service. The remaining graders moved by railway.

Remarks.—The grading of the new crop commenced on the 19th July and proceeded smoothly until the last maize was graded about the 15th October. The grading was always well ahead of loading.

Weevils made their appearance exceptionally early, and in most cases this was found to be due to the use of old grain bags, or to infestation from meal stores on the farms. A total of 20,000 bags of slightly weevily maize was shipped *via* Beira. Several complaints from the Chief Grader at Beira were received concerning maize having been railed in dirty

trucks, and also concerning a proportion of the bags having been used to an undue extent for reaping on the farm, and thus weakened; but, nevertheless, no unusual quantity of broken bags was reported from Beira.

Several consignments of maize contained a high percentage of broken and chipped grain, due, no doubt, to the use of too small screens in the shellers, and running the latter at too high a speed.

Maize Graded during 1934.

1932-33 Crop—	
Graded by Government Graders—Mashonaland	1,868
,, ,, ,, —Bulawayo ...	2,375
1933-34 Crop—	
Graded by Government Graders—Mashonaland	397,666
,, ,, ,, —Bulawayo ...	
Graded by Maize Control Board...	300
Grand total for year to end of November	402,209

Maize Meal.

Graded at Salisbury	2,340 bags	(1932-33 crop)
,, Bulawayo...	4,139 bags	(3,792 bags 1932-33 crop)
Total for year	6,479	

Sunflowers ... ... 10,478 bags graded.

1933-34—*Maize Exported during period* 1.8.34 *to* 12.10.34.

To Beira	317,600 bags
To Bechuanaland	4,523 ,,
To Northern Rhodesia	850 ,,
Total	322,973 bags

Witchweed.—This parasite still remains a serious menace to the maize growing industry, and although there has been a considerable increase in the amount of land put under trap-crops in the Mazoe Valley in the past two years, reports from the Lomagundi, Fort Victoria, Gatooma and Hunters Road areas indicate that the pest is on the increase in these districts, and the position there requires investigation during the coming season.

Many farmers who are attemptng to control the pest by hand-cultivation are failing in their object through allowing too long an interval between cultivations. No longer interval than 14 days can safely be allowed unless every witchweed plant which is in flower is removed from the land at each cultivation, in which case 3 to 4 weeks may be considered a safe interval, providing supervision of the work is really thorough.

The results of the exact series of experiments carried out at the Salisbury Experiment Station over the past 5 years have established the fact that 2 crops ploughed under in one season of Sudan grass and white Kaffir corn (and almost certainly amber cane also) are very nearly as efficient green-manures as a crop of sunnhemp, and are equally efficient as sunflowers, as measured by the yields of two following crops of maize. This important fact makes the control of the pest a simple and inexpensive matter, since these trap-crops can be substituted for the green-manure in the rotation, and in this way the parasite is controlled, and at the same time the humus supply of the soil is maintained, at little or no extra cost over normal.

These experiments also indicate that one trap-crop ploughed under, gives as high yields from the first maize crop following and a loss of only about 12 per cent. on the yield of the second crops of maize as compared with two trap-crops ploughed under in one season. This question is being further investigated in a new series of experiments commencing this season. The results of the above-mentioned experiments have been published in an article on witchweed which appeared in the November issue of the *Rhodesia Agricultural Journal*.

The Assistant Agriculturist. Mr. S. D. Timson, carried out further enquiries into economical methods of controlling the parasite—*Striga lutea*—and the following extracts of his report are quoted.

"Further spraying trials, using a 1½% solution (1½ lbs. in 10 gallons of water) of sodium chlorate, were carried out on his farm by Mr. Geo. Bryson in co-operation with the Department, and the results obtained confirm those obtained

in previous trials. Spraying, however, can at present only be looked on as a substitute for hand-cultivation where infestations are light and patchy, which would be particularly useful where labour is scarce. The chief objections to it are the capital cost of efficient apparatus and the poisoning effect on the maize crop, which takes place through the junctions with parasites, as well as through the soil and by direct contact with the leaves of the maize plants. Where infestations are general and heavy the loss due to poisoning of the maize would make it an uneconomical practice, except where labour is unobtainable.

Contrary to reports by farmers, experiments carried out by the writer indicated that the time interval to flowering after witchweed plants are cut off at ground level is more than the normal 21 days instead of less, but this is not conclusive and more observations on this point are required.

Several farmers have had complete success with broadcasting amber cane on a maize stubble and covering it by disc-harrowing as is common practice in sowing sunnhemp. It probably is better practice to disc-harrow the stubble before sowing.

Either method will show a saving as against ploughing the stubble before sowing, since at least two disc-harrowings will also be necessary as a rule.

The Irungu sorghum seed obtained from India for testing as a trap-crop has been distributed to five farmers in the Mazoe Valley for trial this season. Seed of native Sudan grass has also been distributed to farmers in the Mazoe Valley for trial as a trap-crop."

The following notes and articles on the control of the parasite by the writer have appeared in the *Rhodesia Agricultural Journal*:—

(1) Poisoning of Stock by Sorghums.
(2) Review of "Studies in Phanerogamic Parasitism," by A. R. Saunders, D.Sc.
(3) Witchweed—in November *Rhodesia Agricultural Journal.*

Wheat.—*Tours of Wheat Areas.*—In June a lecture tour of the main wheat-growing areas south of Salisbury was undertaken by the Assistant Agriculturist in company with the Chief Irrigation Engineer and the Plant Breeder, by arrangement with the Rhodesian Wheat Growers' Association. Seven meetings of wheat farmers were addressed in the five-day tour.

Observations made by the Assistant Agriculturist on this tour, generally speaking, indicate that the stands of wheat were found to be very thin still, and the rates of fertilising very low. The average rate of application of fertiliser would appear to be around 100 lbs. of superphosphate per acre, with no potash, nitrogen or lime applied. Even with the present low rates of fertilising the rate of seeding is low. If, however, the rate of seeding is to be increased appreciably, the rate of application of fertilisers must be greatly increased also, and potash, nitrogen and lime should be applied in addition to phosphates on all the vlei lands. Even after green-manuring it is considered that a dressing of nitrogenous fertiliser is required. Evidence of this is yielded by the wheat variety trial. The analyses of the soil of the plots on Rubenvale, on which a heavy crop of sunnhemp was ploughed under previous to sowing, and the growth of these wheats, which received a dressing of 200 lbs. of double maize fertiliser at seeding, supply strong evidence of this. The growth on the whole was good, but showed no signs of being too rank.

In September Mr. Sansom and Mr. Timson made a further visit to the Umvuma and Chilimanzi districts to inspect the wheat variety trials, and the Reward wheat issued for testing to Messrs. Hallam and Hamman. The latter showed considerable promise, being particularly rust resistant both there and in the wheat variety trials on Rubenvale.

Wheat Variety Trials.—The wheat variety trials carried out in co-operation with Mr. E. G. Raubenheimer on his farm Rubenvale yielded results which are unusually significant and having a remarkably low standard error. The results are given below:—

	Early Gluvas.	Quality.	Reward 21-22.	Kenya Governor.	Lal Kassar Wah.	Karachi.
Mean yield per acre (bags)	8.48	6.55	7.03	8.29	7.32	6.43
Percentages of the mean yield (7.714 bags per acre)	110.1	85.6	91.2	107.6	95.0	83.5

	Seln. ex Riverina.	Punjab 8A.	Reward 23-25.	Garnet.
Mean yield per acre (bags)...	8.44	8.39	7.36	8.85
Percentage of the mean yield (7.714 bags per acre) ...	109.6	108.9	95.5	114.9

Standard error of a difference=.05 bag per acre.
=0.65% of the mean

t=2.052 therefore a significant difference between variety yields is 2.052 x .05=.10 bag per acre.

On September 14th the average percentage stand of a full stand reckoned on the basis of one plant every 2 inches in 12 inch drills was 85%.

The two strains of Reward and Kenya Governor were notably more resistant to rust than the remaining varieties, and Garnet and Riverina were markedly less resistant. A report on these trials was forwarded to the Rhodesian Wheat Growers' Association.

It is a matter for regret that adequate financial assistance has not been available to carry out the much-needed experimental work with wheat on this typical moisture retaining soil to include the testing also of the various cultural and manurial problems regarding which definite advice is frequently sought. Experimental work on Rubenvale has allowed only of the small variety trial reported above.

The sum of £25 has been applied for on the new estimates to guarantee the continuity of the present work on Rubenvale.

Summer Wheat.—Samples of summer-grown (sown in late January and February) were received from four sources for identification, and in each case the variety was found to be Kenya Governor.

Agricultural Experiment Station, Salisbury.—The total rainfall for the season was 31.54 inches, which amount nearly equals the average annual precipitation. On the whole the season was a favourable one for nearly all crops, though unusually copious rains fell during November and they delayed planting operations somewhat. The lack of rain during March prevented late sown crops from maturing.

A detailed report by the Manager, Mr. H. C. Arnold, of the experiments in progress during the 1932-33 season was published in the September and October issues of the *Rhodesia Agricultural Journal* and the continuance of those experiments formed the major portion of the field work during the year under review.

Pasture Experiments.—The following extracts are quoted from the Manager's report:—

"Investigations regarding the suitability of a number of indigenous grasses for grazing have been continued. These indicate that we have some three or four kinds of stoloniferous grasses which can be successfully established as pastures and that during the rainfall period some of these are capable of providing pasture which in quantity and quality compare fairly satisfactorily with the pastures of older countries.

The comparative results of the trial plots during the season 1933-34 quoted as the number of days grazing for a single ox which an acre of the respective grasses would provide are as under:—

Woolly Finger ...	238 days	Hunyani	238 days.
Milanje	190 days	Creeping False Paspalum	385 days.
Reed Timothy—underplanted with stoloniferous grasses			243 days.
Mixed stoloniferous grasses			351 days.

In some cases more than one ox was grazed on a plot at a time, and in some cases as many as three oxen. This explains why Creeping False Paspalum has yielded more than 365 days' grazing in a year. In other words, its carrying capacity during the grazing period was considerably greater than one beast per acre.

With very few exceptions our best pasture grasses produce very little seed, and it is therefore necessary to propagate them by means of root division. This method has its disadvantages, mainly that it is a very costly one for the rapid establishment of pasture grass over large acreages, and with the object of testing promising seed bearing species the Peddie strain of Woolly Finger grass, and the Kafue strain of Rhodes grass have been introduced. In addition to these, six of the more promising strains of finger grass, including the Peddie strain, were imported through the courtesy of the Department of Agriculture of the Union of South Africa.

Molasses Silage.—Experiments were again conducted to test the value of this method when applied under local conditions to our commonly grown legumes. Experiments conducted at Grootfontein, in the Union, had shown that better results are obtained when 2% of molasses is used, and that proportion was applied in our experiments; but cane sugar was substituted for molasses owing to its being cheaper locally. Samples of the fodder were taken for analysis by the chemical branch of the untreated and the treated fodder, both before and after curing, but the results of the analysis failed to show that any advantage as regards the retention of the proteins was secured by the treatment. The results therefore confirm those obtained in the previous season.

The palatability of the treated fodder seemed to be slightly better than that of the untreated fodder, though it was not eaten as readily as maize silage. The fodders under test included dolichos beans, velvet beans, soya beans and sweet potato vines.

This experiment showed that fairly palatable silage can be made from the annual legumes usually grown in this Colony without the addition of molasses, if the precuation is taken to ensile the material before it is too mature and to

chop it into short lengths before ensiling it. Molasses is comparatively expensive in this Colony, and unless it could be obtained at a much lower rate than at present, its use would be uneconomic.

The increase in palatability due to the addition of molasses suggests that the fodder of the saccharine sorghums, which can be easily grown in this Colony, could be used in the place of molasses and prove more economical. This method will be tested during the coming season.

A party of British farmers visited the station in March and were much interested in what they saw. Mr. Crawford mentioned that he had visited many Experiment and Demonstration Stations all over the world, but that he had never seen better work done than that which is being done at this Station.

At the request of the Director of the Plant Breeding Station at Aberyswyth, tests were commenced of a number of different types of lucerne, in collaboration with twelve other stations in various parts of the world.

The issues of seed or other planting material under our scheme of co-operative experiments was as follows:—

Annual crop	216
Grass roots, kudza, etc.	198
Other experiment Stations within this Colony	47
Experiment Stations beyond our borders	64

Recent Introductions and New Strains.—*Somerset Sunnhemp.*—This strain of sunnhemp is now coming into general use throughout the country. Many samples have been issued to farmers all over the country for trial, and in almost every case reports have been favourable. Its seed yield is about 50 per cent. heavier than that of the common strain, and only half the quantity is required for seeding. It is also a more consistent seed-yielder, and more resistant to "leaf-spot" disease. It is a great improvement on the common strain of sunnhemp, and reduces the cost of green-manuring very appreciably. Free seed was issued to sixty-seven farmers during the last three years.

The value of the new sunnhemp may be roughly estimated in the following manner. Until the introduction of this variety many farmers considered it more economical to purchase their sunnhemp seed at 20s. per bag of 200 lbs. than to grow it themselves. The cost of producing the seed may therefore be taken at that figure; 200 lbs. is sufficient to sow 5 or 6 acres and the cost of seed, therefore, is 3s. 6d. per acre. Owing to its higher yield and the smallness of the seed, the new variety will effect a saving of 1s. 9d. per acre. If one half of the 50,000 acres annually green-manured in this Colony are sown to sunnhemp the saving effected on the cost of seed alone will be over £2,000 per annum.

It is seen, therefore, that the discovery of this variety alone will ultimately effect the saving of an amount equal to double the cost of the Agricultural Experiment Station.

Poona Cowpeas.—This variety was introduced from Australia by this Department a few years ago, and shows great promise. It is an upright variety and so can be handled by machinery in making into hay. It is also a heavy seeder. Heavy rains near maturity tend to make it lose its foliage, and for that reason it should be sown late—probably not earlier than the first week in January.

Wintersome.—This new fodder crop, bred by a South African farmer, promises to give heavier yields for silage than maize or the sorghums. Having a high sugar content, it is considered that it might take the place of molasses in making legume silage, and this possibility is being tested.

Soya Beans.—The Otoxi variety, a hybrid bred on the Salisbury Experiment Station and formerly known as Selection No. 6, has given very good results under test in many districts, and can be recommended as a high quality legume hay crop for soils in good "heart" and has the great advantage over dolichos, velvet beans, and Kaffir beans, that it is upright in growth and so can be handled easily by machinery. It is also a heavy seeder.

The O-too-tan variety, one of the parents of Otoxi, can also be recommended as a hay crop, though its yields of hay are slightly lower than those of Otoxi.

Madagascar Butter Beans.—Selected seed of this bean was introduced and distributed to a number of farmers for trial on irrigated land a few years ago, and it gives considerable promise as a profitable rotation crop for wheat under irrigation. It is a perennial crop requiring a very long growing season, and support for the vines in the form of a trellis work. These beans are the most popular variety of dried cooking beans on the British market, owing to their fine flavour and rapid cooking qualities.

Vi-Vi (*Leucœna glauca*).—This leguminous shrub has been under trial for a number of years at the Salisbury Experiment Station and also recently by a number of farmers. It shows considerable promise as a browsing crop for winter feed for stock and grown in association with pasture grasses, as it is of very high feeding value (judging by its analysis) and is very palatable. Its chief virtue is that it remains green all through the winter on dry lands. It must be protected by fencing from game for the first year or two of its growth, until it is well established, but thereafter it should prove a valuable winter stock feed.

Somerset Velvet Beans.—Under trial this variety of velvet bean has proved itself far superior to any other of the many types tested by this Department, both as a hay crop, and more particularly as a grain crop. As a hay crop it is superior to dolichos beans, and as a grain crop it has produced far greater yields per acre of concentrate protein for stock-feeding than any crop grown in this Colony. Its yields of grain has been as high as 20 bags per acre containing nearly half a ton of crude protein. Arrangements have been made for testing the feeding value of the beans in comparison with other protein concentrates at the Matopos School of Agriculture. Free seed was issued to fifty-five farmers during the last three years.

Pelargonium.—All varieties, excepting *P. radula*, introduced last year, were increased and are being propagated under field conditions. The variety *P. radula* has proved difficult to "strike," and both parcels of cuttings from Kenya and Kirstenbosch failed to root.

Staff.—The writer was absent on six months' leave from the 1st March to 31st August, and during that period the duties of the Agriculturist were ably carried out by the Assistant Agriculturist, Mr. S. D. Timson.

The establishment and supervision of the Unemployed Settlement at Chilimanzi has added to the work of this Branch, and monthly visits to the Settlement were undertaken by the Agriculturist since its inception in October last.

Officers of this Branch were called upon to judge the maize and produce classes at several Shows.

A comprehensive branch exhibit from the Experiment Station was staged at the Salisbury Show.

Mr. H. C. Arnold, the Manager of the Agricultural Experiment Station, has continued to manage the Station with initiative and ability.

Chiller Steers, the progeny of good bulls.

The First Seven Months Working of the Livestock Improvement Scheme

By A. E. Romyn, Chief Animal Husbandry Officer.

The scheme has met with very general approval from the farming community. Two hundred and ninety-four applications for grants were received up to the 31st December, 1935. The number of applications would probably have been considerably larger, except that it was necessary to advise farmers in September last that funds available had been temporarily exhausted. A number of persons consequently did not put in applications who might otherwise have done so.

The allocation of the grants to date has been as follows:—

	Number of applications.	Number approved.	Number not approved or withdrawn for various reasons.
Cattle	218	109	60
Sheep	31	12	10
Pigs	25	9	11
Total	274	120	81

Not yet dealt with 73.

The chief reasons for the non-approval of grants were (*a*) inefficient livestock management; (*b*) neglect of the cattle on account of attention to some other enterprise, such as tobacco or maize growing.

The applications for bulls have been very unevenly distributed as far as the different breeds are concerned, and there has been a serious shortage of bulls of certain breeds. Approximately one half of the total applications made were for Red Poll or Friesland bulls. There were insufficient bulls of these breeds in the Colony, and consequently a large number of grants were held up for a period while applicants whose farming methods were considered satisfactory were looking for bulls. It must be explained that an applicant is given a definite period in which to purchase the animal

for which he has made application. If the purchase is not completed in that time the money earmarked is allotted to the next man on the waiting list. As a result of the delay in purchasing bulls within the prescribed time funds became temporarily exhausted early in the year and reallocations are still being made.

The scheme has been of great value to the industry. I would estimate that approximately one half of the applicants who have purchased bulls with the assistance of these grants would not have been able to acquire fresh blood in their herds this year if it had not been for the help. The value of fresh blood in many cases is hard to over-estimate, as numerous farmers, owing to the shortage of funds, have had to breed bulls back to the daughters, and even grand-daughters. The scheme has also had a definite educative value in that all farms are inspected before grants are made, and farmers in many cases are advised to modify their livestock management practices. As experience in the working of the scheme was gained it was decided in certain cases not to make a grant until the necessary improvements had been effected, and in this way the provisions of the scheme definitely ensured an improvement in conditions for livestock on the farm concerned.

In about one-third of the cases the bulls were actually selected for the farmers by members of this Division, and in this way men who were not able to select their own bulls were ensured of getting bulls which were likely to prove satisfactory. The majority of large white boars were selected by officers of this Division.

The conditions under which the scheme was administered have been published, and it is not necessary to state them here. Owing to shortage of funds it was only possible to make one grant for the purchase of female stock.

This year it has been impracticable to insist on any high standard of farm management. During 1936 it is suggested, therefore, that a definite standard of farm management should be laid down, below which no grants should be made. The standard should be discussed very fully with representatives of the Rhodesia Agricultural Union so that the Department in its action may have the support of the farming community.

I would recommend that grants for beef bulls should only be made in cases where sufficient provision has been made for the supplementary feeding of young stock in the winter months, and where sufficient fencing is already erected, to ensure that the heifers will not be served before they are sufficiently mature. Without sufficient feed and fencing it is seldom possible to raise good beef cattle in the Colony, and to make a grant under such conditions for the purchase of a good bull is generally to waste public funds.

In the case of dairy farming the "dairyman's calf" should be guarded against, and it should be laid down that any farmer requiring a grant for a dairy bull must be able to show that his calves are well cared for.

In districts remote from a railway, or where it can be shown that cattle can be satisfactorily run for the time being without the provision of fencing or supplementary feeding, some relaxation might be made in the above standards.

Conditions for the purchase of Africander bulls might be less rigorous than for bulls of the imported breeds.

Difficulties have arisen during the past year in regard to the standard of bulls approved under the scheme. The principle adhered to has been only to pass bulls which are pure bred, though not necessarily registered, that are considered of a sufficiently high standard to improve the average grade herd. There is, however, a large class of bulls which does not come up to the standard adhered to but which might do good in herds of low quality. It seems a pity to cut out this class of bull altogether from a grant while there are not sufficient bulls of the better standard to go round. In the coming year, therefore, I would recommend that two classes of bulls be made:—

Class A.—For bulls which should conform to the present standard, and which should improve any average grade herd. Such bulls must have fair size for age, good constitution and satisfactory development in the hind quarter. A grant of £15 would be made on these bulls, and as far as this Department is concerned they could be used in any herd without further inspection.

Class B.—Would be for bulls that do not come up to Class A standard. For Class B bulls a grant would only be made at the discretion of the Inspector. If the Inspector is satisfied that the bull should improve the herd for which it was intended a grant of £7 10s. 0d. would be made. If, on the other hand, the Inspector considered that the bull was not good enough for the herd for which it was intended, no grant would be made.

On the whole the public have supported the livestock improvement scheme very well and there have been few abuses of the generosity of the Government as far as is known. A grant, however, cannot be expected to change the nature of an applicant, and there have been cases at the start where grants were made contingent on certain improvements being effected, where the applicant has not carried out the improvements promised.

There have been cases in which a certain amount of misrepresentation has been made in regard to the inspection of the bulls. For this reason it is recommended that all bulls on which grants are paid should be branded in future. The bulls should also be ear-tagged with a special ear clip and a bull register compiled showing the breeding performance of every bull branded. In time this register should be of great value. It will show which bulls are good breeders, and arrangements can be made to circulate these bulls and keep them in use as long as possible.

The scheme has been of great value to pedigree breeders in assisting them to dispose of the 1935 crop of bulls. There have been a few instances where the price of bulls has been raised on account of the grants. In general, however, breeders of pedigree stock have not so far taken advantage of the £15 grant to put up the price of their stock for sale. The question would probably arise if the demand for good bulls became stronger, but it is at present too weak in most breeds to enable prices to be put up materially.

An encouraging factor has been the demand for milk records in the case of dairy bulls. It is likely, if things go on as at present, that within a year or two dairy bulls without records behind them will be difficult to sell in the Colony.

The expenses of administration of this scheme this year have been comparatively high owing to the lengthy period during which applications have been submitted. Applications from any particular district have come in months apart, necessitating two or three return trips to the district for the inspection of bulls. In the coming year, therefore, I would recommend that all applications should be submitted with a definite period of, say, one month. The bulls need not necessarily be purchased until before the end of the financial year, but this provision will enable a programme of inspection to be planned, so as to complete the motor travelling in each district with a minimum of expense. At the same time it will enable this Department to have an idea early in the year as to the number of bulls required and, if necessary, arrangements can be made to import them as one large consignment from elsewhere, if they are not available in the Colony. If funds for grants were still available applications which come in after the prescribed date would be dealt with when possible in the course of the ordinary routine duties of the officers of this Division.

During 1936 I would recommend that the Department embarks on a definite culling policy in regard to the small herds inspected. It is well known that culling is not usually effective unless the animals are disposed of immediately after culling. There is a natural tendency otherwise to keep them in the herd for a "better offer" which does not materialise, and they are finally not disposed of at all.

The soundest livestock policy for most of this Colony is undoubtedy to keep fewer stock and do them better. With this in mind I think the Inspectors should definitely offer to cull any herd visited when this appears necessary. Arrangements should be made if possible with the Rhodesian Export and Cold Storage Company or Liebig's Extract of Meat Company to receive these culls at a definite price per 100 lbs. dressed weight, and they should be railed immediately to the works.

I would emphasise that money expended in the improvement of the cattle industry is of fa* greater permanent value than money expended in export bounties, which so far have only had the effect of keeping the industry alive.

Organic Manure in Relation to Wheat Growing in Rhodesia.

ITS IMPORTANCE AND HOW TO PRODUCE IT.

By S. D. Timson, M.C., Dip. Agric. (Wye),
Assistant Agriculturist.

Foreword.—This article is written chiefly for the wheat growers of Rhodesia, but the subject matter thereof is of equal interest to all other farmers in the country, and it is sincerely hoped that they will read it, digest it, and try for themselves the system of manufacture of organic manure described therein. The final pages are devoted to an attempt to show how valuable the latter may be to the maize farmer.

During a tour of the wheat areas south of Salisbury in June, 1934, the writer was struck by two strangely contrasting facts. Every wheat grower he met seemed to be fully conscious of the importance of a proper humus supply in the soil of his wheat lands, but on the other hand in practically no case did he find that any farmer was making a real effort to increase his supplies of humus, even by the simple method repeatedly advised by this Department, of collecting all the waste vegetable matter from the farm and placing it in the cattle kraals in order to augment the supply of kraal manure. This practice alone would help materially.

During that tour the writer suggested a simple method of increasing the amount of vegetable matter available for the purpose, namely, by the growing of sunnhemp on the dry lands during the summer and the reaping and placing of this in the kraals. He has yet to hear of any farmer who has adopted this suggestion, but sincerely hopes that some have.

It has, of course, a limited application in that only a certain quantity of sunnhemp can be accommodated in the average cattle kraal, but it would very greatly increase the

amount of kraal manure produced on the average farm, to the benefit of the cattle as well as the wheat.

Below the writer goes a step further and shows how sufficient humus may be simply and economically manufactured on the farm to give every acre at present under wheat the equivalent of a 10 tons per acre dressing of the best organic manure. This alone would treble or quadruple the present yields of wheat.

It is not proposed to dwell here on the many benefits to be derived from ensuring an adequate supply of humus in the soil to all crops grown in the Colony. It is assumed here that every farmer is properly aware of this, and certainly every grower of wheat on the poor sandy vlei soils on which the great bulk of the Colony's wheat is produced, should be. Most of such wheat growers depend very largely for their livelihood on their wheat crop and the returns per acre are miserably small. There is no shadow of doubt that these small yields are largely due to a lack of organic matter in the soil. Any wheat grower will tell you that he can obtain good yields of wheat, barring the interference of what are called "acts of God," such as untimely frost and lack of moisture, providing he can give his soil a good dressing of farm manure. He should therefore need little urging to adopt the practices outlined below, which will undoubtedly ensure that he can do this, and at the same time minimise as far as possible those calamities mentioned.

Every grower of wheat on the poor sandy vlei soils of the Colony should make a strong and maintained effort to increase the humus content of his soil, by (*a*) green-manuring each summer as much of his wheat land as possible; (*b*) by increasing his kraal manure supplies by (1) collecting all the organic wastes on the farm such as old grass, leaves, maize residues, and so forth, and placing them in the kraals; and also by (2) growing sunnhemp on his dry lands in the summer and reaping and placing the top growth in the cattle kraals to be turned into manure, and at the same time feed his cattle. Finally, by (*c*) making compost outside the cattle kraals of sunnhemp mixed with maize husks, bean crop residues (stems and branches), sunflower stalks and other organic wastes from the farm.

Most farms on the sandy soils of the Colony on which wheat is grown are mixed cattle and wheat farms, and there is almost invariably a considerable acreage of dry land on which sunnhemp can be grown successfully in the summer season, and a large amount of dung for use in making compost.

The sunnhemp is probably best left to mature for a few weeks beyond the normal stage at which it would be ploughed under as green-manure in order to obtain the maximum bulk of organic matter, but it should be cut before the leaves fall.

As much as possible may be placed in the cattle kraals to be partly eaten to the benefit of the cattle and the remainder to be tramped down and converted into manure.

To economise labour the kraals may be situated near the sunnhemp, or *vice-versa*, the sunnhemp may be grown on land near the kraals.

Sunnhemp may be grown on the same land for several years in succession, the stubble being ploughed in each year of course, and such a practice will very greatly increase the fertility and crop-producing power of the land so that heavy crops of maize, bean hay, sweet potatoes, and other cattle feeds can be grown, and these in turn will lead to a greater output of kraal manure and organic wastes for converting into maunre and compost.

Rain-Watered Compost.—The remainder of the sunnhemp, which cannot be used in the cattle kraals, can be converted into compost, which is of much greater value than kraal manure, by the simple means outlined below, which is essentially the Indore process of compost making, which was developed by Sir Albert Howard and modified by Jackson, Wad and Panse at Indore, in India. This process for the manufacture of organic manure from farm organic wastes has now spread to most of the countries of the Empire, and is being increasingly employed in Kenya, Tanganyika, Northern Rhodesia and Nyasaland.

The writer has employed this process successfully during the period September to December, 1934, for making a high quality compost from scrap tobacco and old grass. The

compost was ready for application to the land in between three to four months from the commencement of the work. The materials received one artificial watering at the making of the stack on the 25th September, and thereafter the scanty rainfall sufficed. Artificial watering in this case was necessary to start the process, because it was required to make the compost as soon as possible, but no artificial water supply beyond the normal rainfall is necessary on the farm.

Below is given a brief outline of the method of making compost by the Indore process. No artificial watering is necessary, though control of a water supply for this purpose naturally simplifies and speeds up the work. No materials are required which cannot be found or produced on the farm.

Materials Required.—(1) *Vegetable matter of any kind*, such as weeds, grass, spoilt hay, stalks of maize, cotton and sunflowers, leaves, wheat straw, maize husks, the leaves and finer branches of scrub bush, sawdust in limited quantities, stalks of sunnhemp after threshing, and sunnhemp top growth from crops specially grown for the purpose. *All green materials must be well withered and dried before use.*

(2) *Dung of cattle, horses, sheep or goats.*—About 2 cubic feet of dung per 35 cubic feet of the vegetable waste materials is required.

(3) *Ordinary Field Soil.*—This should always, where possible, be taken from cattle collecting kraals, cattle standings or anywhere where cattle usually stand, since in such places it is urine-soaked and rich in nitrogen. Three cubic feet of soil per 35 cubic feet of mixed wastes is sufficient, but if the supply of dung is short, more urine-soaked soil can be used instead.

(4) *Wood or Vegetable Ashes*, if available, should be added to enrich the compost in potash and to neutralise acids produced in rotting. One cubic foot per one hundred and forty cubic feet of mixed wastes is required, but more may be added with advantage, since all the sandy wheat soils of the Colony are very deficient in potash. Ground limestone in less quantities may be used instead of wood ashes, but this will not supply any potash of course.

Method of Making.— *Site of Heaps.*—A well drained site should be chosen. It is to be preferred if it has a hard smooth surface, as this facilitates the turning over of the heaps.

Making the Heaps.—It is not necessary, but, if the work can be conveniently organised, it is preferable if the mixed organic wastes can first be spread over cattle standings in cattle kraals or cow byres, for a day or two before being placed in the heaps.

The mixed vegetable wastes are made into a *loose well-ærated heap*, 8 to 10 feet broad and 3 feet high, and of any convenient length. The heap should be built up in layers of 6 inches to a foot deep. Over each layer a portion of the dung, field soil and ashes is evenly spread, putting the final dressing of these materials on the top of the heap.

The natives employed on this work must not be allowed to walk over the heap as it is being built or later when it is turned, as *it is of the greatest importance to keep the whole mass as loose as possible*, to assist the maximum penetration of rain and air throughout the heap.

When the building of the heap is completed it is left until sufficient rain falls to penetrate to a depth of 6 to 9 inches. Where only one material is used such as sunnhemp or tobacco scrap alone, it is difficult to ensure adequate aeration, as the material tends to mat closely together. Wherever possible a mixture of a number of different types of vegetable wastes should be used. Maize husks and stalks and sunflower stalks, wheat straw and other materials should be mixed with sunnhemp which will normally constitute the greater part of the materials available for composting. Maize and sunflower stalks will be particularly valuable for assisting aeration of the heaps.

First Turn of the Heap.—As soon as the rain has penetrated the heap to 6 or 9 inches depth it should be turned with forks and made into a new heap at one end or one side. Whilst turning, the materials should be shaken up and the labour should not be allowed to walk over the new heap. The object of this turn is to mix the wet with the dry materials, and to mix the dung, soil and ashes thoroughly with the materials.

Second Turn.—After a month the heap should be turned back in the same way to its former position.

Third Turn.—A month later the final turn is given. The various turnings ensure even distribution of moisture, and aeration, which are essential to success. The turning should preferably be done when it is raining, but this is not essential.

Until he is used to the process and has learned by experience the farmer may find that a fourth turn may be advisable to ensure rapid rotting.

The writer has found that four natives could turn a heap 45 feet by 15 feet by 3 feet high in 6 to 7 hours work. Such a heap contains 75 cubic yards of compost, which is sufficient to dress 10 to 15 acres.

Sowing Sunnhemp on the Heap.—After the first turn sunnhemp should be sown thickly on the top of the heap. A seeding rate of two to four lbs. of the common sunnhemp per 100 square yards of surface is recommended. The writer has found that the common sunnhemp thrives better under these peculiar conditions than the Somerset sunnhemp. The sunnhemp will grow only 6 inches to 12 inches high, but the roots penetrate deeply into the heap, nodules are freely formed and the whole heap is considerably enriched in nitrogen by turning under of the sunnhemp at the next turn. The addition of this nitrogen promotes rapid rotting and enriches the compost.

As already mentioned the writer has found that compost is ripe in three to four months, but *it is not necessary to wait until the compost has completed rotting down before carting and ploughing it under;* and provided rotting has proceeded normally the compost may be spread on the wheat fields and ploughed in immediately after the third turn. Therefore under favourable rainfall conditions, which normally obtain throughout the sandy vlei wheat growing areas in Mashonaland, compost should be ready for riding to the wheat lands within $2\frac{1}{4}$ months from commencing to build the heap. This means that if sunnhemp is sown dry before the first rains in November, compost may be made from the top growth and ready to cart to the lands soon after the end of April.

It will complete its manufacture in the soil in two or three weeks. However, the wheat grower will usually have to organise on a two-year basis, in other words, to be content to manufacture his compost one year for application the following year. The writer urges every wheat grower to commence the making of compost at once without delay, as he is convinced that therein lies the solution of the most pressing of the wheat grower's problems. There is nothing difficult in the process. It merely requires a little energy, a little forethought and a little organisation, and it provides the farmer with the one essential to successful wheat growing that is most lacking to-day, namely, organic manure. Compost made by this process is considerably more valuable than farmyard manure, for the following reasons:—

1. Properly made compost is weed-free, for the great heat generated kills all weed seeds. For the same reasons flies cannot breed in it. The temperature rises to about 140° Fahr. The writer obtained a slightly higher temperature than this.

2. It is more finely divided than farmyard manure, and for this reason is more easily incorporated in the soil, and more rapidly available to the crop.

3. It has a higher nitrogen, potash and phosphate content than farmyard manure.

Sir Albert Howard states ("The Waste Products of Agriculture," by Howard & Wad, p. 76) "taking everything into consideration, Indore compost has about three times the value of ordinary (*farmyard*) manure."

Owing to properly made Indore compost having a higher crop-production value than the best kraal manure as made in this Colony, it is not necessary to apply such heavy dressings of the former to obtain an equivalent result.

A dressing of 5½ tons per acre of Indore compost may be taken as being equal to a dressing of 8¼ tons of farmyard manure.

Organic Matter and the Health of the Crop.—It has been clearly proven all over the world that crops grown on soil containing an adequate supply of humus remain healthier and freer from diseases than similar crops grown in soil

deficient of humus. Furthermore, they are more able to resist unfavourable conditions such as a shortage of water supply, untimely frosts, the attacks of pests and so on.

That high yields of wheat are obtainable on sandy vlei soils when the soil is supplied with organic matter is shown by the results obtained by one farmer in the Felixburg-Gutu area last season. This gentleman obtained a yield of just 12 bags per acre over a small area of two acres, and a yield of 9.1 bags per acre over an area of 5½ acres. There is no doubt that the chief factors in his success are firstly, of course, having control of the water supply on this land by irrigation, and secondly the high content of organic matter, or humus, in the soil. As will be seen the dressing of phosphate applied was very light.

The following is an account in his own words of the treatment this wheat received:—

"The area of 5½ acres was accurately measured off. The wheat sown in the photograph was part of the two acres which yielded 24 bags for the two, or 12 bags per acre. The remaining 3½ acres gave 26 bags the lot.

"The two acres was old winter vegetable garden in 1933 and 1934. The whole 5½ acres was under sunnhemp in 1933-1934 and 1934-1935, which was ploughed under. Last season 100 lbs. per acre of superphosphate was applied.

"This season the land was ploughed before the sunnhemp was sown, the latter was ploughed under and cross-disc-harrowed. A third ploughing was given and the wheat disced in.

"It was irrigated three times—the last irrigation when the wheat was in full flower. I should have liked to have given it a fourth irrigation, but water was scarce."

No doubt there are many farmers who can quote similar experiences of the effects of an ample supply of humus, and there is no doubt that the chief factor which produced such high yields for this class of soil in this case was the comparative richness of the soil in humus brought about by the two crops of sunnhemp ploughed under, and in addition, in

the case of the two acres which yielded 24 bags of wheat the dressings of kraal manure applied in previous years when the land was under vegetables.

Although this article has been addressed particularly to the wheat growers of the sandy areas of this Colony because their soils are particularly deficient in organic matter, nevertheless the subject is one of the greatest importance to all other farmers throughout the country, and it is sincerely hoped that they also will test out the methods of increasing the humus supply of their soils described above.

It is very probable that the present system of turning under the top growth of the green-manure crop is a wasteful one and that much better use could be made of it if it were reaped from the land and converted into compost by the method described below. This may seem a revolutionary suggestion, but the known facts support it strongly; they are briefly as follows:—

Experiments carried out on the Agricultural Experiment Station, Salisbury, between the years 1926 and 1929* indicate that the top-growth of a sunnhemp crop when ploughed under is only responsible for an increase in the yield of the following maize crop of 1.23 bags per acre, or 6.8% over the yield obtained by ploughing under the stubble only. In this particular case the average yield of maize for the three years was 17.91 bags per acre when the whole crop was ploughed under, and 16.68 bags per acre when the stubble only was ploughed under. A later series of experiments† on the result of burning the sunnhemp crop on the land confirm the above.

Now, a good well grown crop of sunnhemp on good red soil should produce in the region of 30,000 lbs. of green material per acre. On the Experiment Station at Salisbury a yield of 34,000 lbs. has been obtained and it is a well known fact that in the Mazoe Valley and Lomagundi districts a much heavier growth of this crop is obtained than at Salisbury. This 30,000 lbs. of green material, after withering for a day or two, will, it is estimated, lose about 50 per cent.

*Annual Report of Experiments, Season 1928-29, by H. C. Arnold.

†Annual Report 1933-34 Salisbury Experiment Station. *R.A.J.*, Sept., 1935.

of its weight, leaving 15,000 lbs. of material ready for composting. On the results obtained at Indore this should yield approximately 73 per cent. of its weight of finished fresh compost (Bulletin No. 2, 1934, Institute of Plant Industry, Indore, by F. K. Jackson, Y. D. Wad & V. G. Panse) or about 11,000 lbs., or $5\frac{1}{2}$ short tons (2,000 lbs.).

Sir Albert Howard, as quoted above, states that the value of compost made by the Indore process is about three times the value of farmyard manure, which is itself considerably more valuable than Rhodesian kraal manure. Let us be moderate and assign to this $5\frac{1}{2}$ tons of compost only, 50 per cent. more than the value of farmyard manure.

What increase in yield per acre of maize can be expected from an $8\frac{1}{4}$ tons per acre dressing of farmyard manure applied to red or chocolate soil which has not been green-manured for, say, three years. The writer estimates that an increase of 6 to 8 bags per acre in the first year, and 3 to 4 bags per acre in the second year after application; this means a return of 9 to 12 bags to be set against a loss of about $1\frac{1}{2}$ bags (over two years) due to the removal of the sunnhemp from the land. These figures are very impressive, and it is hoped that they will lead farmers into testing them for themselves this season. They are warned that the composting of a single material such as sunnhemp is difficult, but mixing of maize stalks and husks, sunflower stalks, old grass and so on with it will solve this difficulty. The heaps of compost can be made on the edges of the fields to which it is to be applied, and the sunnhemp can be raked to the sides of the fields with a horse rake.

The system only requires organising ability and the power of improvisation in order to adapt it to local conditions, and the Rhodesian farmer has shown that he possesses these qualities.

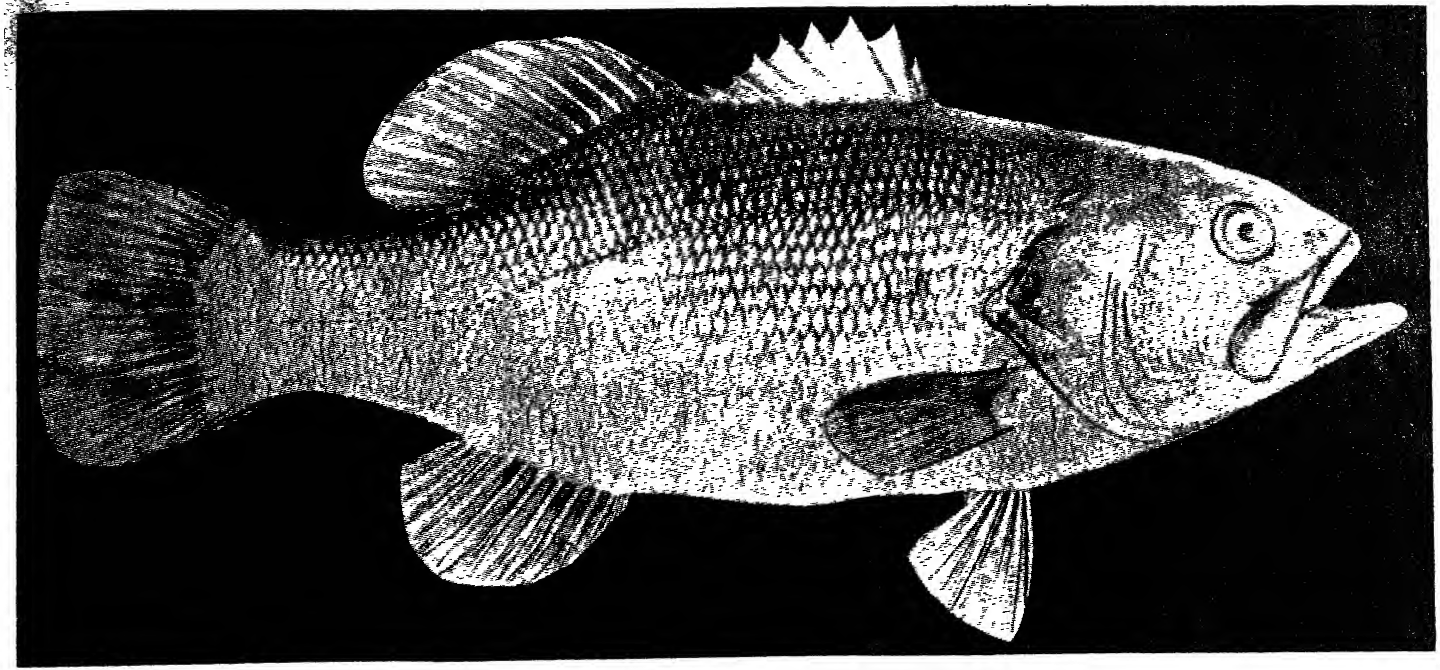
Who is going to lead the way?

A series of experiments has been commenced this year at the Agricultural Experiment Station, Salisbury, designed to test the value of composting sunnhemp as against plough-

ing it under, but several years will elapse before conclusive results are available. It is hoped that farmers will not wait for these results, but *will test the matter for themselves* without delay.

The officers of this Department will willingly give all the assistance they can offer.

In conclusion, it is perhaps desirable to point out that there is no intention in this article to depreciate in any way the value of green-manuring as a regular farm practice; but in the later pages an attempt has been made to indicate that possibly better and more economical use can be made of the green-manure crop than is being done at present.



Large-mouth Black Bass (*Micropterus salmoides*) caught in Paarde Vlei, Somerset West. Length 15⅜ inch. Weight 2 lbs. 7 ozs.

The Prospects of Black Bass
IN THE INLAND WATERS OF SOUTHERN RHODESIA.

SPECIALLY CONTRIBUTED.

In submitting this article the writer wishes to tender suitable acknowledgements to those persons, officials and public bodies who contributed to the matter published in Report No. 4 of the Fisheries and Marine Biological Survey Division of the Union of South Africa dated 1st June, 1934.

The object of this article is to give firstly a short account of the habits and life history of Large-mouth Black Bass; secondly a resumé of the results which have attended the introduction of this species of fish into the inland waters of the Union of South Africa and, thirdly to consider the prospects of the successful introduction of the species into the waters of this Territory.

Habits and Life History.—The species of fish commonly known as Large-mouth Black Bass (*Micropterus Salmoides*) range from Canada to the Gulf of Mexico and from the Atlantic coast to the Rocky Mountains. It is prolific in congenial waters and reaches greatest size in the warmer lakes and more sluggish streams of Southern United States. The maximum weight is from 20 to 25 lbs., though in most localities it does not exceed 6 lbs., and the average is probably somewhere about 3 lbs. Spawning season takes place in the Spring when water temperatures rise above 60° F.

Spawning Habits.—The making of the nest, which is merely a crude depression or a clearing amongst water plants, and the guarding of the nest and the shoal of fry is carried out entirely by the male bass, the female taking no part beyond the actual depositing of the eggs. Actual spawning will extend over several hours, the eggs being emitted and fertilised at varying intervals. The eggs are adhesive and attach themselves to the materials of the nest. The male remains over the nest during the entire period of incubation,

fanning the eggs clean of sediment with a gentle motion of his fins; watchfully guarding against enemies. Nothing but the loss of eggs by low temperatures, heavy deposits of sediment or other adverse conditions will cause him to abandon the nest. Males will not quarrel even if nests be in close proximity and they attend to their respective parental duties in entire amity, whereas the approach of a strange fish will be resented. The incubation of the eggs takes only a few days, depending upon the mean water temperatures. A drop below 55° F. is invariably fatal, whilst the percentage of hatch below 58° F. is greatly reduced. After hatching the fry is sedulously guarded by the male bass; the shoal gradually enlarges in circumference to such an extent that he has difficulty in keeping his brood together. He crowds them into shoal water—their natural feeding ground—and patrols the shore in an effort to ward off enemies, but they finally separate into small bands and so escape the vigilance of the paternal eye and become free lances in the strife for survival. Young bass remain together until 2 inches or more in length. They cannot be fed successfully with artificial food and must depend entirely upon small aquatic crustaceans and insects for their sustenance. After reaching a length of 2 to 3 inches bass, under natural conditions, feed largely on fish, and it has been found that they will make a much better growth if fish are included in the diet than when their food is confined to insects and crustacea. Fingerling bass are naturally cannabalistic, and the greater part of the losses during the first summer usually are due to this habit. Using forage fish in ponds has proved conclusively that the production of bass can be increased materially by stocking the ponds with minnows on which the bass feed; and the tendency on the part of fingerlings to devour each other is largely overcome. The bass fry grow very rapidly. Experiments show that fry 9/16th of an inch placed in a pond on the 7th June increased in size to 2.5 inches by the following September; in the case of a few selects they grew to 8 inches in length. The highest production of large-mouth bass by these intensive methods was at the rate of 11.550 three inch fingerlings per acre. That quite small two-year-old bass may be expected to spawn was proved in 1928 when 15 two-year-old bass (five cocks and ten hens) produced 12,219 fry, an

average production of over 1,200 fry per female. The 15 two-year-old spawners averaged only slightly over 3 ounces in weight each when placed in the pond.

The following recommendations are made for the stocking of large-mouth bass in enclosed waters by American authorities:—

(1) Spawning ponds from which fry can be netted and for transfer to nursery ponds, can be stocked with 75 (50 females and 25 males) 2 lb. bass, or 110 (75/35) 1 lb. bass per acre. The adults would require to be fed on minnows, etc., at frequent intervals in such heavily stocked ponds.

(2) Combined spawning and rearing ponds from which fry are not removed can be stocked with 15 (10 females and 5 males) 2 lb. bass, or 25 (17/8) 1lb. bass per acre. Such a pond should be stocked with breeding minnows to supply forage fish.

The explanation why ova are not available for purchase is because, unlike trout, the spawn cannot be extracted.

Successful Introduction into the Union of South Africa.—Black bass were first introduced into the Union of South Africa on the 20th February, 1928, when 45 bass fingerlings were imported from Holland by the Government Trout Hatchery at Jonkers Hoek, Stellenbosch, Cape Province. By October of the same year these fry had grown to 10 inches, but they did not breed at that stage. By the following Spring (October-November, 1929) the bass spawned and a good crop of fry resulted. By February, 1930, the local bred fry had grown as long as three inches. In June of that year it was possible to make a limited distribution of the local bred fingerlings. The first distribution was made in the Cape area and the fry were planted in rivers, reservoirs and vleis and have done consistently well in their different environments. Thanks to the public-spirited attitude of the Cape Explosives Works at Somerset West exceptionally good results have attended their efforts in the "Paarde Vlei" Dam. So well have these fish grown and multiplied that fishing with artificial lures has already been possible, and by December, 1933, fish

weighing 3 lbs. 2 ozs. had been taken. It is the opinion of those competent to judge that the success of black bass in South African waters is assured.

Paarde Vlei Dam, Somerset West.—The phenomenal success of the work at Somerset West is of particular interest to Southern Rhodesia, as the conditions at "Paarde Vlei" are very similar to and by no means more favourable than those which obtain in many of our dams and confined waters. A short account is therefore given of these experiments. The Paarde Vlei is an ordinary enclosed dam and is the source of the water supply of the Cape Explosives Works. It receives its water in the winter months from the overflow of the Lourens River. The water is passed through a bye-pass canal where the silt is deposited. By this means nothing but good clear water reaches the vlei. The capacity of the vlei is 220 million gallons and in extent 133 acres. The vlei has an abundance of plant life, including *Nitella Hyalina* (a charaphyte). This soft and moss-like growth varies in height from several inches to a couple of feet, depending upon the depth of water. These plants afford splendid cover for the young fish, when the drying of the marginal area of the vlei drives them forth from the shallows. Secondly, the many microscopic forms of plant life and animal life which lodge on it are a potential source of food supply to the larger animals on which the bass feed. On the shallower parts are found *Nitella dregeana* and *Potemogeton capensis*. It is suggested that sheets of water which recede considerably in the dry season have a more varied aquatic life than those which are permanent. The conditions produce a higher degree of small animal life (*Crustacea daphnids*, snails, etc.), and there are several variety of plants, rich in fish food, not present in the permanent waters. The lowering of the water in late summer is accordingly a piscatorial benefit.

Indigenous Fish.—The dominant fish in the vlei before the introduction of black bass was the Cape "Kurper" (*Anabas capensis*). This species existed in great numbers. The great initial success of the 1931 class of bass seems to be largely due to the number of Kurpers which were available as forage fish. Kurpers occurred almost to the exclusion of all other food in the stomachs of bass caught during 1933. As far as

could be ascertained the vlei contains no other indigenous fish life, not even catfish (commonly known as barbel). It is thought that the predatory habits of the Kurper wiped out all fish of the minnow family which should be present at Paarde Vlei, as in most of the streams and dams of the Cape.

Four hundred and ten adult fish were captured during 1933 for stocking other waters, a large number of these weighed up to 3 lbs. 2 ozs.

The first fish planted was on the 20th July, 1930, when 21 fingerlings about four inches long were released. A second lot, 15 in number about 10 inches long, were planted on May 25th, 1931. No bass were actually seen spawning, because there were only a few adult fish present in the large expanse of water. In 1932 some of the spawning fish were watched, and it is recorded that one nest was made and stocked with ova in the Power House sloot. The nest was made against the steep bank of the sloot and a shoal of fry resulted. By the Spring of 1933 the number of spawning fish was greatly augmented by the maturing of the 1931 bred class of bass.

On October 8th, 1931, with the water at 64° F. some fish were taken on lures in the vlei for release after marking. These bass were about 2 lbs. in weight and the females could be distinguished by the distension of the abdomen. It was possible to express some of the ova by gentle pressure, but it was not found possible to get the milt to flow from the male fish. From October 8th the temperature was maintained at 65° F., but fell later to 60° F. On the 23rd October a female fish was taken oozing ova so that it was evident spawning would not be long delayed. On October 28th (temperature 68° F.) a pair of bass were seen spawning for the first time. On November 25th a male fish was seen guarding a shoal of newly hatched fry. On the 6th January, 1934, a large male bass was seen to be guarding an enormous shoal of fry in the cut-off. These fry were from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches long and there were thousands of them. The male fish kept close to the legs of the observer and the fry made no attempt to disperse when a few were netted out. The temperature in the shallows on this date was 80° F. One thousand fry were taken from this shoal and it was estimated that this represented only about a tenth of those guarded by the male.

Stomach Contents and Food Supply.—During the fishing season, January to July, 1933, many of the bass taken had empty stomachs, but of the others such records as Kurper in stomach, and fish in stomach, occur in monotonous regularity. During July many large bass were found to have been feeding upon Covixid water-boatmen. During October it was observed that large bass were taking the red males and yellow females of the libelluline dragon fly, which were plentiful during that month. The bass would jump right out of the water to take the dragon flies as they hovered over the surface of the water. Several bass were taken on artificial dragon flies. A change from the almost exclusive diet of the previous fishing season was noticed when fishing recommenced in January, 1934. In twelve instances the larvæ of dragon and demoiselle flies and other water insects were found, and large grasshoppers in two instances. Five bass contained fresh water crabs and the remains of frogs and tadpoles were found in 19 instances and water snails in two. A large bass was found to contain the remains of a passerine bird, probably a water-wagtail. There is little doubt that the supply of Kurpers was very much reduced since the introduction of the bass. The persistence of this food in the stomachs of bass during the first fishing season indicates that they ignored the other forms present whilst this favoured forage fish was easily obtained.

It is interesting to mention that bass have been taken at Paarde Vlei on a great variety of artificial lures. Many patterns of loch, seatrout, salmon and American bass flies were used with success. White, red and silver flies appeared to attract the bass. On the whole spinning lures have been found to take more bass than artificial flies, and of these the "mother of pearl" spoon was perhaps the most successful in boat fishing. Metal fancy spinners and artificial minnows were also used. The American diving and floating "plugs" were also found to be useful. It was therefore evident that the bass were prepared to be catholic in their diet and take what food was available.

Prospects of Success in Southern Rhodesia Water.—Having read of the success of the Paarde Vlei Dam experiments anyone who has an intimate knowledge of our local rivers and

dams must agree that the prospects for the permanent establishment of black bass in this country are assured. Our waters possess the correct temperatures and an abundance of aquatic plant life, upon which the small fry live. The quantity and variey of both water and flying insects are practically unlimited. For forage fish our rivers and dams are stocked with countless millions of minnows of various species which are regarded by authorities to be pre-eminently the best food for bass. We have also other indigenous species, such as bream, in three kinds, barbel, silver fish, yellow fish, not to mention crabs, snails, frogs and other surface and underwater animals too numerous to mention.

Efforts of the Salisbury and District Angling Society.—The Salisbury and District Angling Society has been successful in obtaining a supply of 98 two inch fingerlings from a Union source, and these were released on the 1st January, 1936, into a combined spawning and rearing pond which, through the generosity of Messrs. Lamb Bros., of Eskbank, Salisbury, has been placed at the disposal of the Angling Society. These fish, it is hoped, will spawn in the Spring of 1937, when the Society hopes to have a good supply of fingerlings for distribution and planting in suitable dams and streams within the area coming under its jurisdiction. The Society also hopes in due course to be able to supply other similar Societies with fry and to issue a limited number to farmers with suitable waters, so that the streams throughout this and other areas may become stocked with as little delay as possible.

The Salisbury and District Angling Society, which has jurisdiction over the Salisbury Magisterial District, is to be congratulated upon its energy and enterprise in introducing this species of fish, which should do well in Southern Rhodesia, especially in the warmer waters, and it is hoped that all followers of Izaac Walton—and there are quite a number amongst our farming friends—will give the Society the support, financial and otherwise, which it deserves.

Some Aspects of the Plant Virus Problem.*

By Kenneth M. Smith, D.Sc., Ph.D.

Potato Virus Research Station, School of Agriculture, Cambridge.

There appears to be rather a tendency on the part of botanists to consider the study of plant viruses a dull subject and one without any sure foundation in fact. It is hoped, therefore, in this short article to show that, on the contrary, the subject is not only an intensely interesting one, involving problems of fundamental biological importance, but is also of extreme economic importance and that plant virus workers really have a definite problem in hand.

No one at the present time knows what a virus is and this uncertainty as to its nature adds, perhaps, to the interest of the study. In speaking of a virus, stress is usually laid upon certain properties which are mainly negative in character such as inability to see the virus with the miscroscope, impossibility of cultivating the virus on media outside the host and the fact that viruses cannot be held back by the usual bacteria-proof filters. Improving methods of technique, however, are showing that some of these qualities are merely relative and it is already possible to photograph some viruses by means of the ultra-violet light microscope and to devise filters which will allow viruses to pass or hold them back at will according to the pore size of the filter.

In speculating upon the nature of viruses, whether of animals or plants, as a whole, it is well to remember that they are a heterogeneous collection of disease agents and it is by no means certain that they are necessarily all of the same nature. At one end of the scale is the virus of Psittacosis or parrot fever, the particle-size of which is 250 millimicrons

*Address to Section K, British Association meeting, Norwich.

(1 millimicron equals one-millionth of a millimetre) and which is in consequence within the range of the ordinary microscope. This virus appears to have a definite life cycle and is presumably a living organism. At the other end of the scale is the virus of foot-and-mouth disease which has a particle-size of about 10 millimicrons and is only two or three times the size of an oxyhaemoglobin molecule. It is difficult to conceive of this as a living organism. Certain plant viruses are also very small, the particle-size of tobacco necrosis virus is only 20-30 millimicrons and that of a newly described tomato virus is only 17-25 millimicrons. Again, there is the recent claim of Dr. Stanley [14] of the Rockefeller Institute in Princeton that he has succeeded in crystallising out the virus of tobacco mosaic which he considers to be an autocatalytic protein, *i.e.*, one which acts upon the cells of the host in such a way as to compel them to produce more of the same substance.

For the present it will perhaps suffice to adopt the definition of viruses given by Gardiner [5]—"as agents below or on the border-line of microscopical visibility which cause disturbance of the function of living cells and are regenerated in the process."

In this short survey of the plant virus problem, it will only be possible to deal with one or two of the more interesting aspects of the subject and it is proposed, first of all, to discuss a few of the symptoms produced in affected plants. Since the pathological effect on the plant is almost the only criterion of the existence of a plant virus, the study of symptoms necessarily plays rather a large part. There are various kinds of virus diseases which may be loosely grouped together as follows, the *mosaic* type where attack on the chlorophyll induces the formation of mottlings or rings; the *destructive* type which induces necroses of the cells in leaves and stems, and a third type which produces *deformities* or *overgrowth* in the affected plants.

Some of the mosaic viruses produce colour changes in the flowers of affected plants. Perhaps the best known example of this phenomenon is the so-call "Tulip-breaking" in which tulips affected with a mosaic virus produce variegated flowers.

Certain of these tulips with variegated flowers at one time fetched large sums of money owing to the mistaken idea that they were new varieties, whereas they were in reality only diseased specimens of self-coloured varieties. References to this tulip "breaking" may be found in the literature of very early times. Thus, the first record is a description published in 1576, and other accounts of this variegation in tulips appeared in 1622 and 1670. It was in this latter account that the suggestion was first made that the variegated tulip might be diseased. In the Rembrandt Exhibition recently held in Amsterdam were paintings of tulips by Dutch artists of the sixteenth and seventeenth centuries, and many of these tulips showed a typical mosaic infection. Just recently, growers of the favourite blood-red variety of wallflower have been perturbed by the appearance of an ugly yellow stripe or flecking in the red flowers and this has led to many complaints from customers that their colour schemes have been spoiled; similarly with self-coloured stock [10]. The variegation in these flowers has been shown to be due to a virus carried to the plants by a species of greenfly from virus-infected broccoli or cauliflowers in the neighbourhood.

In the writer's opinion viruses play a larger part in the production of variagations in flower colours than is usually supposed. For instance, inoculations from the petals of common variegated mauve and white and mauve and yellow violas, picked at random from the garden, to healthy tobacco plants of the White Burley variety, produced in those plants a virulent mosaic disease. The virus is also capable of infecting several other species of Solanaceous plant. Experiment seems to show that the virus causing this variegation is a strain of cucumber mosaic virus (cucumber virus I).

Some of the mosaic viruses affecting ornamental plants may produce little effect on the plant other than the change in the colour of the flowers. It is quite likely therefore that a systematic enquiry into the question would show that other familiar flower variegations may be due in part to virus infection. There seems, however, to be a common element in the appearance of this type of variegation, *i.e.*, a pencilling or flecking of the colours and a break in the hard line dividing two colours.

The next question is the important one of how plant viruses are transmitted in nature from diseased to healthy plants. The majority of plant viruses depend upon insects for their dissemination from plant to plant and this relationship between insect and virus is one of considerable interest. The insects concerned in the spread of plant viruses are nearly all of one type, a type of insect which feeds in a particular way which seems to be well adopted for the injection of the virus into the plant. These insects belong to the order Hemiptera and are of the sap-sucking type.

Insects are not merely mechanical vectors of the virus but in all probability some kind of obligate relationship exists between the two. The following facts seem to bear this out —certain viruses cannot be transmitted from diseased to healthy plants except by the agency of insect and often only by one species of insect or one type of insect and not by other closely related species; some insect vectors having fed once upon a virus-diseased plant remain infective for the rest of their lives without the necessity for further recourse to a source of virus infection. This suggests that the virus actually multiplies in the body of the insect. Further, some insects do not become infective until a minimum time has elapsed after feeding upon a virus-infected plant. This is often referred to, perhaps on insufficient grounds, as the "incubation period" of the virus in the insect. A better term would be "a delay in the development of infective power within the insect." This delay may be as long as ten days in some cases.

It is not possible to deal at length with the question of the insect relationships of plant viruses, but space permits touching upon some recent interesting work on this subject. Storey [15], working upon the leafhopper which transmits the streak disease of maize in East Africa, has found that there exist two distinct races of this insect. One race which can transmit the virus and one race which is unable to do so; these races are termed *active* and *inactive* respectively. There is no visible difference between the inactive and active races and both are of the same species. Further, Storey has shown that if a puncture is made with a fine needle in the wall of the gut or alimentary canal of the inactive insect, the insect then becomes capable of transmitting the virus. It would

appear from this that there may exist some factor or factors connected with the structure of the wall of the alimentary canal in inactive insects which prevents the virus from passing through into the blood and so reaching the salivary glands whence it is injected into the plant.

The next point concerns the mechanism of movement of the virus in the plant. Since most viruses rapidly become systemic in their hosts, there is evidently an efficient means of transport about the plant. It has been shown by Bennett [1], Caldwell [2] and others that if the phloem in a portion of the stem of a plant is destroyed by steaming, the virus cannot pass over this bridge of dead tissue. In other words the virus is moving in the phloem but not in the xylem. The disease will develop normally in whichever half of the plant is inoculated, but the virus will not pass from the upper to the lower nor from the lower to the upper half, across the bridge of dead tissue.

The general movement of a virus about the infected plant has been well demonstrated by Samuel [9]. His experiments show that there is no movement of tobacco mosaic virus from the inoculated leaf for a period of 3—4 days. The virus then passes out of the inoculated leaf and travels rapidly to the roots of the plant; about a day later it travels with equal rapidity to the top of the plant. In pot plants the more mature leaves become successively invaded from the top downwards and from the bottom upwards until the plant is completely invaded by the virus.

The movement of the virus in the plant thus seems to be of two kinds: first, a very slow cell-to-cell movement *via* the connecting protoplasmic bridges until the phloem stream is reached, when the main and most rapid movement about the plant begins. Further confirmation of this is afforded by some experiments with a newly discovered virus known as tobacco necrosis [13]. This virus produces only necrotic symptoms and thus etches out, as it were, its own movement through the plant. Photographs have been taken at two-day intervals of the path followed by the virus in the leaves of cowpea (*Vigna sinensis*). The first six photographs show merely a gradual increase in size of the lesion at the point where the

virus has entered the leaf. As soon, however, as the virus enters the phloem it begins to travel rapidly through the leaf, moving in 48 hours over a much greater distance than in the whole of the preceding 12 days' slow cell-to-cell movement.

On another aspect of the subject two interesting discoveries have recently been made: firstly, it has been found that some plant viruses exist in a number of closely allied strains, and secondly it has been shown that infection with one strain of a virus will immunise a plant from infection with another strain of that virus. Space will not suffice to allow of a discussion as to whether these strains actually arise by mutation from existing strains, but the evidence rather indicates that this is the case.

The immunity conferred upon a plant by a virus strain against other strains of the same virus is of the non-sterile type. There is apparently no question of the production of antibodies and it is the presence of the first virus which inhibits the entrance of the second strain. This type of immunity is well shown in the case of potato virus X [8], tobacco [6] and cucumber mosaic viruses [7] and by the virus of tomato streak [11]. All these viruses exist in strains and the "green" and "yellow" strains of the tobacco or cucumber viruses are particularly suitable for this kind of experiment. If a healthy tobacco plant and one systemically infected with a "green" strain of tobacco mosaic are inoculated with a "yellow" strain, the healthy plant develops the yellow spots characteristic of this virus, while the plant already infected with the "green" strain is protected against invasion by the "yellow" strain. A similar protective action is exerted in the case of a plant infected with a "yellow" strain against invasion by the "green" strain. It should perhaps be emphasised that the presence of one virus in a plant is no bar to the entrance of a second virus of a different type, the cross immunity holds good only for like viruses and virus strains. This kind of immunity therefore is likely to prove a useful tool in the work of classifying viruses and in distinguishing like from unlike viruses in those cases where diagnosis by symptoms alone is unreliable.

A possible practical application of this type of immunity lies in the protection of a crop from infection with a severe virus by previous artificial infection with a mild strain of the same virus. Here, however, lie a number of pitfalls, chief of which is the unfortunate liability of certain viruses, even when in a mild form, to give rise jointly with another virus of a different type, to a much more severe disease than is produced by either virus acting separately.

Mention must be made of a comparatively new method of approach to the plant virus problem, *i.e.*, the discovery that the introperitoneal injection of rabbits with plant virus extracts induces the production of *antibodies* in these animals. These antibodies react specifically with the *antigen* (virus sap) in some observable way. Three types of immunologic reactions have been demonstrated, complement-fixation, precipitation and neutralisation of the pathogenic properties of the virus. Such neutralisation is specific for each virus, thus, tobacco mosaic virus is inactivated only by anti-tobacco mosaic serum, and tobacco ringspot virus only by anti-tobacco ringspot serum and so on. The cross specificity is absolute and the addition to any of the viruses of a heterologous antiserum exhibits no effect. This specificity, however, does not extend to distinctions between virus strains even when the strains produce very different symptoms in the host plants (Chester [3]).

This new technique is likely, therefore, to prove a useful tool in the difficult task of classifying and differentiating plant viruses.

Since viruses are so often spoken of as filter-passing or ultra-microscopic, and described by other adjectives referring to their small size, it may be of interest to give a few details of the actual magnitude of some viruses. The sizes of virus particles can be measured with fair accuracy by means of ultrafiltration through collodion membranes, the pore size of which can be measured. These membranes are prepared by a special technique devised by Dr. Elford [4] of the National Institute of Medical Research at Hampstead and the process of their manufacture is too complicated to describe here. It has been found by the application of this technique that plant

viruses vary very much in their particle size, ranging from 75 to 100 millimicrons for a potato virus down to 17-25 millimicrons for a new tomato virus.

In conclusion it is proposed to give a short account of an interesting new virus, because it well illustrates the kind of problem with which the virus worker is sometimes faced. It has been found at Cambridge [12] that a high proportion of the normal stock of healthy tobacco plants carry a virus in the roots but not in the stem and show no signs of disease during the whole of their life. Under certain conditions, however, in the winter and early spring the virus may pass up into the plant and develop disease symptoms in the lower leaves. Unlike most other plant viruses, this virus does not become systemic in the host. Further, and this is the most interesting point, tobacco seedlings which by available methods of inoculation have been shown to be virus-free, yet contain the virus in their roots in quite large quantities some five weeks later. The following experiment illustrates this. Seed from a White Burley tobacco plant grown in the insect-proof house was sown in sterilised sand in a "cellophane" cage in the glass-house. From the resulting seedlings a number of small plants were chosen and all the roots cut off except that one root was left on each plant. The roots of each plant thus removed, were ground up and the resulting paste inoculated separately to three or four cowpeas, a plant which is extremely sensitive to the virus. The tobacco plants were then repotted in sterilised soil and allowed to grow on; from this number 48 plants, the roots of which had given no reaction upon the cowpeas, were selected for a second test. This was made, again to cowpeas, 5 weeks after the first test. The plants were by this time about 8 inches across with a well-developed root system, and showed no unusual symptoms. Of these 48 plants 32 gave a virus reaction. In considering these results certain other facts must be borne in mind; exhaustive tests make the possibility of outside infection by seed, soil or water-transmission unlikely, though seed transmission in some form cannot definitely be excluded. The virus is not insect borne.

There seem to be three possible explanations of this problem: first it may be assumed that the virus is present

all the time in the stem, but present either in a non-virulent form which requires to gain virulence by concentration in particular cells of the root, or else in a dilution too great to give a positive reaction on inoculation. This theory, of course, involves seed transmission of the virus in undetectable form or quantity. The second possible explanation is that the virus is arising spontaneously within the plant. The third possibility, and perhaps the least likely, is the existence of a mode of virus transmission at present quite unsuspected.

Virus workers have long dallied with the idea that a virus might arise *de novo* within the host. Such a suggestion is attractive in some ways and it would explain many things which are at the moment obscure. If viruses are considered as organisms or at least possessing some of the attributes of life, the suggestion of their heterogenesis is repugnant. If, on the other hand, Stanley's view that a virus may be an autocatalytic protein is accepted, then there seems no particular reason why the theory of spontaneous development of the virus within the host should not also be accepted. It is, however, at present still an open question and much work remains to be done before this question can be answered.

REFERENCES.

1. Bennett, C. W. (1927), Agric. Exp. Stat. Mich. State Coll. Tech. Bull 80.
2. Caldwell, J. (1930), Ann. Appl. Biol., 17, 3, 429-443.
3. Chester, K. S. (1934), Phytopath., 24, 11, 1180.
4. Elford, W. J. (1931), Journ. Path. and Bact., 34, 505-21.
5. Gardner, A. D. (1931), Microbes and Ultramicrobes, Methuen's Biological Monographs.
6. Kunkel, L. O. (1934), Phytopath., 24, 5, 437-66.
7. Price, W. C. (1934), Phytopath, 24, 7, 743-61.
8. Salaman, R. N. (1933), Nature, 131, 468.
9. Samuel, G. (1934), Ann. Appl. Biol., 21, 1, 90-111.
10. Smith, Kenneth M. (1935), Gard. Chron., 2537, 112.
11. —— (1935), Parasitology, 27, 3, 450.
12 —— (1935), Nature, 136, 395.
13. —— and Bald, J. G., Parasitology, 27, 2.
14. Stanley, W. M. (1935), Science, 81, 2113, 644-5.
15. Storey, H. H. (1933), Proc. Roy. Soc. B, 113.

SOUTHERN RHODESIA.

Locust Invasion, 1932-35.

Monthly Report No. 37, December, 1935.

The only species of locust recorded in the Colony during December has been the Red Locust (*Nomadacris septemfasciata*, Serv.). Swarms have been described mostly as "large" and have been reported from various districts, including the following:—Charter, Marandellas, Goromonzi, Mtoko, Hartley, Salisbury, Zaka, Bulawayo, Plumtree, Matobo, Mrewa, Bikita, Inyanga, Rusape, Insiza, Lomagundi and Mazoe.

The white bellied stork (*Abdimia abdimii*) has been much in evidence attacking locusts, also the brown hawk (*Milvus ægyptius*).

There is no record of disease or parasites amongst the locusts to date.

No reports of egg laying have been received, but from specimens examined egg laying should commence about the second week in January, 1936.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

NOVEMBER, 1935.

There have been no cases of contagious disease in the territory, except one of anthrax in the old infected area, Mtoko district.

TUBERCULIN TEST.

One bull, two cows and one heifer were tested upon importation with negative results.

MALLEIN TEST.

Twenty horses were tested upon entry; no reactions.

IMPORTATIONS.

From the Union of South Africa:—Bulls 1, cows and heifers 3, horses 20, sheep 1,365.

From the Bechuanaland Protectorate:—Sheep 180, goats 25.

From Portuguese East Africa:—Pigs 25.

EXPORTATIONS.

To the Union of South Africa for local consumption:—Oxen 120.

To Northern Rhodesia:—Sheep 42.

EXPORTATIONS—MISCELLANEOUS.

To the United Kingdom in Cold Storage:—Chilled beef quarters, 6,412; frozen boned beef quarters, 7,405; tongues, 10,358 lbs.; livers, 19,940 lbs.; hearts, 4,614 lbs.; tails, 1,958 lbs.; skirts, 2,880 lbs.; shanks, 16,698 lbs.; kidneys, 1,773; sweet breads, 72.

MEAT PRODUCTS.

From Liebig's Factory:—Beef fat, 23,000 lbs.; corned beef, 51,600 lbs.; tongues, 4,680 lbs.; meat meal, 10,000 lbs.: horns, 6,543 lbs.; hoofs, 6,281 lbs.

From Rhodesia Export and Cold Storage Co., Ltd.—Bacon 809 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon

Southern Rhodesia Weather Bureau.

DECEMBER, 1935.

Barometric Pressure.—The mean monthly pressures again averaged about one millibar above the normal values.

Temperature.—Daily mean temperatures were on the whole slightly below normal. In general the greatest maximum temperatures were recorded on the 5th, and the lowest minima on the 1st of the month.

Rainfall.—Except in the north-eastern districts the rainfall during December was barely half the normal for the month, the south-eastern areas receiving even less. In spite of unsettled weather during the early part of the month, ideal rain conditions were not established. The most general rain occurred on the 20th, and was due to tropical air being displaced by the cold air of a southerly high.

DECEMBER, 1935.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	100	57	89.7	65.7	77.7	78.3	77.1	67.8	62	62	.	2.52	4.57	8	...
Beit Bridge	963.6	...	104	57	92.0	70.3	81.1	...	78.0	66.5	56	61	4.3	0.79	2.45	3	1,500
Bindura...	890.8	...	93	58	84.0	64.8	74.4	...	72.2	64.0	65	59	3 7	5.16	6.78	9	3,700
Bulawayo	868.0	867.1	93	51	83.0	60.8	71.9	71.7	70.4	60.8	61	54	6.5	3.09	5.12	11	4,426
Chipinga	892.3	...	87	52	77.4	59.1	68.4	...	70.3	62.3	68	58	5.6	4.35	7.69	10	3,685
Enkeldoorn	857.3	...	89	50	81.1	58.8	69.9	70.7	69.4	60 6	62	56	3 5	1 39	6.53	6	4,788
Fort Victoria	894.6	893.7	93	53	83.5	61.7	72.6	73.0	72.7	63.2	62	58	4.4	1 27	5.63	9	3,571
Gwaai Siding	903.2	...	100	51	88.7	63.4	76 1	...	74.5	65.3	63	60	5.9	4.07	5.05	14	3,278
Gwanda	905.6	...	97	53	85 9	64.9	75.4	...	72.6	62.2	59	57	5 8	1 57	4.60	7	3,229
Gwelo	861.9	...	92	51	82.8	60.0	71.4	71.9	70.3	61.0	61	55	4.8	2 33	6.00	11	4,629
Hartley	884.7	...	94	50	84.8	61.5	73.2	73.8	73.1	63.2	59	57	3.8	4.58	6.86	8	3,879
Inyanga	836 6	...	83	42	76.0	54 8	65 4	...	67 1	59 2	64	54	3.9	2.54	7.03	9	5,514
Marandellas	837.5	...	86	49	77.4	55.6	66.5	...	66.7	59.0	65	54	4.4	2.25	7.44	6	5,453
Miami	878.2	...	90	56	81.3	62.2	71.8	...	70.8	63.4	68	59	5.3	2.75	5.92	12	4,090
Mount Darwin ...	906.8	...	96	54	86.0	64.1	75.1	..	73.8	65.3	65	61	4.6	6.50	6.19	7	3,179
Mount Nuza	801.6	...	72	45	65.0	51.1	58.1	...	60.0	55.3	85	52	6.3	7.61	...	13	6,668
Mtoko	876.8	...	91	54	83.1	62.1	72.6	...	72.1	63.6	64	58	3 4	...	6.58	...	4,141
New Year's Gift...	...	...	95	55	84.7	61.0	72.8	...	73.3	63.6	57	58	...	1.82	5.91	8	2,690
Nuanetsi	960.6	...	106	57	91.9	67.3	79.6	...	79.0	68.4	60	63	3 4	0 89	2.82	2	1,581
Plumtree	863.7	...	93	51	82.5	63.4	73.0	..	71.9	60.7	55	53	4.1	3.30	5.46	11	4,549
Que Que	881.2	...	94	54	86.0	62.0	74.2	...	72.6	62.1	57	56	5.1	1.62	6.20	5	3,999
Rusape...	861.8	...	88	47	79.9	58 4	69.2	...	67.8	60.7	68	57	3 6	4.34	7.53	7	4,648
Salisbury	854.2	853.5	89	49	81.0	58.7	69.9	69.6	70.8	61.9	61	57	5 0	3.39	5.86	12	4,885
Shabani	909.3	...	99	55	86.1	64 0	75.1	...	73.4	64.6	66	60	6.2	1.01	4.80	6	3,131
Sinoia	887.6	...	94	52	85.4	61.9	73.7	...	73.3	63.8	60	58	3.4	4.62	6.89	8	3,795
Sipolilo	884.4	...	91	55	82.0	62.6	72 3	...	73.7	63.4	58	57	4.4	2.04	7.04	5	3,876
Stapleford...	841.9	...	81	38	72.1	51.3	61.7	...	63.9	59.5	79	57	5.7	8.82	10.83	13	5,304
Umtali...	892.2	891.6	92	51	82.5	59.7	71.1	71.9	71.2	64.1	69	60	5.0	2.95	5.29	6	3,672
Victoria Falls ...	...	...	...	...	...	...	...	...	...	...	...	..	...	2.82	6.35	9	2,990
Wankie	925.7	...	104	62	92.6	70.7	81.7	...	79.7	67.5	56	61	6.7	2.22	4.77	11	2,567

Rainfall in December, 1935, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
1	...	...	...	...	10	...	...	...	...		...	..	16	...	...	11	3	24	45	20	36	48	...	..	..	..	...	13	15	12	...	253
2	..	...	...	...	7	4	...	7	9	2	...	...	...	..	...	12	6	...	5	80	13	19	...		.	...	...	...	...	4	...	168
3	...	...	...	...	...	1	...	...	35	6	2	...	...	...	...	17	170	1	...	102	18	18	1	12	...	4	..	...	3	...	...	390
4	...	...	...	...	32	7	..	2	...	...	...	..	46	..	...	20	4	18	7	47	36	21	..	..	...	...	..	...	4	13	...	257
5	.	...	...	...	7	9	...	...	8	29	13	31	11	4	...	22	1	7	14	28	27	13	29	...	...	..	1	3	...	21	...	278
6	...	...	...	...	6	...	..	...	...	...	31	13	44	11	5	1	47	113	...	133	...	...	..	...	...	..	..	...	4	1	...	409
7	...	...	...	...	1	...	...	1	1	2	6	6	6	31	1	27	32	80	17	123	12	3	2	...	..	...	...	...	3	...	...	354
8	...	...	...	...	9	...	...	...	...	3	31	49	17	21	7	3	43	90	3	39	3	7	6	...	...	..	...	...	...	...	8	339
9	...	...	...	...	28	8	...	4	...	6	4	...	24	30	...	3	73	18	17	115	26	4	39	...	...	...	.	..	..	...	4	403
10	...	...	...	...	...	..	...	...	...	...	...	7	17	159	...	4	87	212	6	93	8	1	...	...	...	...	...	.	...	..	...	594
Mean	...	...	...	...	11	4	...	2	3	6	8	9	19	18	1	13	27	44	16	73	21	16	10	...	...	.	...	3	4	7	1	316

Farming Calendar.

FEBRUARY.

BEE-KEEPING.

In most part of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due. which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, *i.e.*, to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees. either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month. and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first two insects should be heavily pruned or destroyed. The budworm caterpillars can usually be hand picked during the process of topping. (See *Rhodesia Agricultural Journal*, December, 1927.)

Potato.—Ladybirds and tuber moth may call for attention. The latter, when very bad, sometimes causes considerable wilting of the crop besides attacking tubers. The ladybirds may be destroyed by spraying with arsenate of lead 1lb. to 16 gallons of water.

Cabbage Family.—All members of the family are liable to be attacked by the sawfly and webworm. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime (1 lb. Paris green and 20 lbs. slaked lime).

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of goards. Destroy all badly "stung" fruit and spray remainder thoroughly with arsenate of lead (2 ozs. in 4 gallons of water) to which 2½ lbs. of cheap sugar has been added.

Deciduous Fruit.—Apples, pears and late peaches suffer chiefly from fruit moths, which puncture the fruit. No remedy available except covering the trees with netting.

Fig.—The fruit is liable to the attack of the fig weevil. All infested fruit and all wild fruit should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon bisulphide into the burrow and sealing it up.

Poison Baiting.—Poison baiting against surface beetles, cutworms, etc.: No really effective bait has yet been discovered for cutworms, but the following poisoned bait is recommended for surface beetles, etc.: Paris green 1 lb., 180 lbs. maize meal. Mix thoroughly in dry state and add water until the material is of the consistency of a dough. Roll into small balls and place under shade. Spread in the evening.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gilias, larkspur. dianthus and pentstemon. The uower garden should be now looking its best, nearly all

plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions. carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons. Take care in setting out the plants, avoid bending the roots, and do not plant deeper than the plants were in the seed beds or trays. Steps should be taken to prepare seed beds for the slower growing species, *i.e.*, pines, cypresses and calitris, and seed of these species should be sown for the following season's planting.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition. but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand. etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onions and thick milk, are the chief reason sfor non-success in the breeding of turkeys.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Be careful that the condition of the bulls is maintained, especially

in the case of well-bred animals. A bull in poor condition cannot be expected to sire a large number of calves. As far as practicable cut veld hay during this month. Usually the optimum relation of yield and composition occurs now. During this month, in addition to maize, some protein concentrate such as peanut cake or cotton-cake will generally be necessary in the dairy cow mixture to keep up a good milk flow. Increase the grain ration to bullocks which are being fattened on grass and add some protein concentrate to their feed to make good the deficiency of this nutrient in the grazing.

Sheep.—Continue as recommended for December. If heavy rains are experienced, a daily ration of half a pound of maize per ewe will help to keep them in condition. Those who favour autumn lambs must put the ram again with the flock in February, and should take steps to supply a little extra feed to fit the ewes for mating. Start putting in green feed for ewes due to lamb in April or May.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition, and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months. frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or lukewarm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheese-making, and great care should also be taken of the starter. If this latter shows any signs of gassiness or develops any diagreeable flavour or colour, it hould be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

WEATHER.

This is often the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, 7½ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

MARCH.

BEE-KEEPING.

As the latter end of this month should herald the approach of the second and last real honey flow of the season, see that enough extra supers are ready for placing on hives as required, watchinig also that the fully drawn out combs of shallow frames that are on hand to fill them with are kept free from the wax moth; further, examine all supers that are already on the hives for this serious defect, though strong colonies will as a rule keep the combs free from this pest. March being usually a hot month, look well to the entrance; enlarge when and where necessary, and have ventilating lids on the tops of each hive. Extra ventilation can be provided for when required by placing small metal or wooden wedges underneath the top super, but not to be open enough to let out or in a single bee. Where quilts are noticed to have been eaten or more or less destroyed during the summer months, now is the time to make fresh ones so as to be ready for the closing down and the making snug of each hive when winter approaches; old flour bags or old deck chair canvas make capital quilts. Bees during this month will consume a quantity of water; see that some is always kept in the apiary in floating cork chips. This will save much labour and flight for them, as well as prolong their period of work and usefulness. As stated in last month's notes, flying swarms may be expected now any day, so prepare for their capture if required by having all details and items ready for immediate use. It is as well, however, at this date of the season to do without such swarms, unless the owner is prepared to feed them well during the winter months. March or April swarms, unless they are hived under conditions of providing all the frames, of fully drawn out old combs, do not as a rule have either the time or materials to provide for a strong colony before the winter sets in, and must perforce remain a weak one during that period. The axiom of every bee-keeper should be to let his colonies go into winter quarters brimming over with bees, not only to provide against the mortality that is bound to occur then, but to have a full hive to start the next season with.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irriga-

tion, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until the latter end of April.

CROPS.

Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits. Ridge late potatoes, and if weather is dry prevent ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Late in the month begin to cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles *at once*. Lift ground nuts that are sufficiently matured. Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Sow onion seed beds for winter crop. Watch the weather for hay-making and take advantage of fine spells. Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped from them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of Algerian oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witch weed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood may now be found in the stalks, but nothing can be done at this stage. Caterpillars sometimes attack the crop as a sequel to cultivation after grass weeds have made too much growth. The caterpillars attack the crop on account of their more natural food being suddenly destroyed. Prevention and not cure is indicated.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but leaf miners and budworms may be in evidence. The latter are usually destroyed by hand when topping. Any plants affected with stem borer should be removed and destroyed.

Potato.—If ladybird beetles or caterpillars are injurious, spray with arsenate of lead (powder) 1 lb. to 30 gallons of water. Careful hilling should be attended to with the object of preventing and checking tuber moth attack.

Vegetable Garden.—If sawfly attacks plants of the cabbage family dust with Paris green 1 lb., fine sifted slaked lime 20 lbs. Against cabbage louse (aphis) wash plants frequently with a strong spray of water. Destroy blister beetles by hand. Plants of the melon family may be baited regularly with arsenate of lead (powder) 1½ ozs., treacle ¼ gallon (or cheapest sugar 2½ lbs.), water 4 gallons, to keep down fruit flies. For leaf-eating caterpillars and beetles, etc., spray with arsenate of lead (powder) 1 lb. in 30 gallons of water on foliage which will retain water. Cabbages are best dusted.

Citrus Trees.—Collect and destroy infested fruit to keep down citrus codling. Fruit-piercing moths sometimes attack the fruit during the month, especially navels. They work at night and can only be dealt with at present by hand destruction. The trees should be watched for development of aphis and soft brown scale on the young growth and prompt measures taken. Resin wash at two-thirds standard strength is suitable.

Mosquitoes, House Flies, etc., may be very prevalent during March. Destroy breeding places. Poison or trap adult flies. Attend to screening of residence.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbages and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FORESTRY.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

GENERAL.

At this time the condition of stock on the veld is usually good. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding pens should have all been mated up by now, as the first chicks should be out by the beginning of April. Much more care should be used than is usually the case when selecting birds for breeding. Only the very best, i.e., the strong, healthy, vigorous ones from the best layers, should be chosen. A pamphlet on "Selection and Mating for Improvement" can be obtained on application to the Editor or the Poultry Expert.

This deals fully with the subject. Always keep an eye on the male bird; many are apt to get thin and run down in health, due to their allowing their mates to eat all the food. Such birds are better breeders than those that chase their mates away from the food. Every male that is being bred from should be given a good meal by himself each day, to ensure health and vigour. The incubator should be thoroughly overhauled, cleaned and disinfected before the eggs are put in.

STOCK.

Cattle.—Arrangements for winter feed should be pushed on. For a well balanced winter ration, in addition to good quality veld hay, a succulent feed such as maize silage, majordas or pumpkins and a legume hay such as velvet beans, cowpeas or dolichos beans are essential. The milk supply will begin to decrease. In the case of cows rearing calves it is often good policy in this month to cease milking cows and to allow the calves to get all the milk from now on. Slightly increase the amount of grain to the dairy cows and increase the proportion of protein concentrate in the dairy cow mixture to make good the usual loss of feeding value in the grass. Bullocks fattening on grass will do better for a daily ration of some succulent feed such as green mealies or sweet potato tops.

Sheep.—Grass seed may be very troublesome. Keep the sheep on short grazing, or, alternatively, put them on to grazing which has been mown. Crutch the ewes due to lamb.

DAIRYING.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily.

Calves which are under four months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates. An ample supply of clean water should be provided in the calf run.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned, if necessary.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy eeason tapers off in an irregular and often erratic manner and without certainty.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Training Hawks to Protect Crops.—Some time ago Capt. J. M. Moubray, of Chipoli, Shamva, wrote to this Department concerning the possibility of developing a trade in hawks trained to protect crops from birds. He stated: "I see in Canada they are now training hawks to protect orchards from fruit eating birds. In one instance four or five hawks protected a large orchard and the saving from fruit eating birds was tremendous.

"There are not a great many cases in Rhodesia where this means of protection could be applied, but there are a large number of orchards in the Union—also there are several large wheat growers who would probably be only too glad to make use of such birds to protect their crops.

"We have large numbers of the hawk species in Rhodesia. I suggest therefore that you institute enquiries as to those kinds that would be suitable with a view of establishing an export industry in these birds. The scheme is not as wild as it appears at first sight."

This subject was referred to Capt. C. D. Priest, who replied that in his opinion the scheme is an excellent one and quite practicable. With regard to the capturing and training of hawks a very useful review is found in the Appendix of Vol. I. of Capt. Priest's "The Birds of Southern Rhodesia." The information given consists of extracts from Mr. C. H. Donald's book "The Birds of Prey of the Punjab." Several methods of capturing are given and a short account of the method of handling and training. Capt. Priest concludes the appendix as follows: "I have not heard of Falcony being practised in Southern Rhodesia as yet, but have had letters from a correspondent at Monze, in Northern Rhodesia, where apparently this exciting pastime has been experimented with. There is no reason also why it should not be practised on some of the great plains of Southern Rhodesia, where conditions would be ideal.

After reading Mr. Donald's paper, we notice that none of the larger Birds of Prey are mentioned as being of much use, but we should have little difficulty in catching and training some of the Goshawks, Kestrels and Falcons, with which the country abounds. Of our Falcons the Lanner would be the most serviceable and the South African Kestrel. It would be interesting to know if Mechow's Goshawk could be trained; the little banded certainly could be. Kestrels, however, are only good for very small "game."

Any further information or suggestions from any of our readers would be greatly appreciated.

Rhodesian Apples.—As a result of a recent tour of the Marandellas, Rusape and Inyanga districts, Mr. Marshall, the Horticulturist, reports most favourably on this season's apple crop. In his opinion the crops in practically every orchard were of outstanding quality and confirmed his opinion regarding the best varieties for the districts.

The areas with an altitude of between 4,000 and 5,000 feet are suitable for Rome Beauty, Versfeld and Alma (Lady Carrington). Areas of over 5,000 feet between Rusape and Inyanga grow a much wider range of varieties—at Inyanga Estate all the varieties under test have exceeded expectations—six-year-old trees on seedling roots are carrying up to 3 and 4 bushels of fruit. These comprise Commerce, Delicious, Wine Sap, King David, Rhode Island Greening, Chenimuri, White Winter, Pearmain and Versfeld's.

The older Blenheim, Orange Pippin, King of Pippins, Syke House Russet, Lord Wolsley, Yellow Belfleur and other varieties are responding to better treatment. The 30-year-old Greenings should average 8 bushels of fruit this year, and one old Versfeld should produce about one ton or between 40 and 50 bushels of fruit.

The excellent results obtained this season should be an incentive to the recently formed Fruit Growers' Association to take every possible step to secure the most perfect organisation possible, and to see that everything necessary for handling the crop is available to its members. Several growers find themselves with splendid crops but without suitable packing material. It must be realised that to establish a market for any commodity the method of packing is of the utmost importance. It is suggested that the Association could render a most useful service to its members by purchasing collectively suitable packing materials in good time for the next crop.

Apple Packing Demonstration.—The Horticulturist gave a demonstration of apple packing at the Inyanga Estate on Saturday, February 15th. The Rusape-Inyanga Fruit Growers' Association is to be complimented on the enthusiasm shown. The fact that practically every grower was present indicates a splendid spirit which should be encouraged. It is not too much to hope that with careful attention there will be no need to import apples, nor will there be any inclination to do so if the quality produced this season can be maintained or improved.

British Commonwealth Conference.—It is proposed to hold a Scientific Conference in London during September and October next at which scientific and administrative officers will be present from all parts of the Empire. Mr. A. D. Husband, the Chief Chemist, who will be in England at the time on leave, and Mr. B. F. Wright, Official Secretary to the High Commissioner, will be the official delegates from this Colony. The main object of the Conference is to provide an opportunity for the discussion of all the important subjects which affect two or more of the countries represented, and to endeavour to arrange for research on co-operative lines. There are so many subjects of this nature that it is anticipated that the Conference will last three weeks, and there is no doubt that most important results will be achieved. Every part of the Empire has been asked to submit proposals for the consideration of the Conference, and a suggested outline agenda prepared by the United Kingdom Committee has been submitted for consideration. The main items concern crop improvement and plant breeding; the control of insect pests and plant diseases; the treatment of the diseases of human beings and domestic animals by drugs and chemical compounds; the review of recent investigations of animal diseases; insect-borne diseases; malnutrition; agricultural economics; soil erosion; food preservation and transport; fuel, and finally an endeavour to find means for the closest possible co-operation between scientific workers in all parts of the Empire.

Animal Husbandry Experiments at Matopos.—The work of determining the cost of production and fattening of various types of steers for export as chilled beef is being widened and continued.

Different lots of steer calves are being managed and fed to reach chiller weight at approximately eighteen months, two and a half and three and a half years. These lots will be marketed separately at Smithfield and information obtained as to the most profitable age at which to market cattle overseas, taking all factors into consideration.

A lot of approximately forty three- and four-year-old heifers have been put on feed to be exported as chilled beef. A considerable amount of heifer beef is consumed in the United Kingdom, and if these heifers sell satisfactorily as chilled beef, an opening will be created for the marketing of good type beef heifers which are surplus to local requirements.

The work on mineral supplements has been extended to include a group fed on the salt and iron oxide lick recommended by the Chief Chemist. This group of cows and calves will be run under natural conditions on more or less free range on sandveld and accurate breeding growth and weight records kept to measure the effects of the lick.

Sunnhemp is being grown in order to give it a thorough trial as hay and green feed for different types of stock. Although the Department is not in a position to recommend this crop for feeding on any scale, the results of these experiments will go a long way towards proving whether the results claimed by some farmers are justified or not.

Velvet beans are also being tried in a similar manner as a feed for pigs, and the effects of feeding this crop on the finished products will be awaited with interest.

Results from Glenara Soil Conservation Experiment Station

1934/35 SEASON.

By C. L. Robertson, B.Sc., A.M.I.C.E., Chief Engineer, Irrigation Division, and
A. D. Husband, F.I.C., Chief Chemist.

During 1934 a Soil Conservation Experiment Station was established at Glenara, near Salisbury, on land kindly loaned by the owners, Messrs. Newmarch and MacLean, for the purpose.

The land is an area of red soil, representative both as regards slope and character of the majority of the arable land in the Mazoe Valley, the averge slope being 1 in 30. A storm drain on a grade of 1 in 200 was constructed above the land which was then protected by two contour ridges, the upper one being on the normal grade of 1 in 400 previously recommended by this Department as being the safest grade to adopt, and the lower one on a flatter grade of 1 in 1,000. Both ridges were built to the standard dimensions, the upper one being 315 yards and the lower one 340 yards in length, the upper one receiving the drainage from 5.59 acres and the lower one receiving drainage from 4.69 acres of land.

The flood water discharged from each ridge is passed over a right-angled V notch and the depth of flow recorded on an automatic instrument. The charts available from these instruments enable calculations to be made of the total discharge from the ridges during each individual rainstorm. A sharp angled V notch at right angles to the main notch

diverts a fraction of the flow to storage tanks of 30,000 gallons capacity and the water level in these tanks is also automatically recorded.

During the season under review the tanks were never completely filled and about 1-15th of the total flow was stored in them. At the end of the dry season after the water had evaporated off, the silt in each tank and in the settling traps behind the main notches was measured and weighed and enabled an accurate estimate to be made of the amount of silt eroded from each protected area.

Chemical and mechanical analyses of the soil in the lands and of the silt collected were carried out in the Division of Chemistry and a discussion by the Chief Chemist of the results obtained is included in this article.

The object of the experiments was to determine the relative efficiencies of the two types of ridges in reducing erosion and flood run-off and also to supply data as to the peak rate of discharge during rainstorms of particularly heavy intensity and thus afford an indication as to the height of ridge necessary to ensure protection under the severest of conditions.

An automatic raingauge was installed at the station which enabled measurements to be taken of the rainfall intensity. During the season under review the areas under observation were planted with maize and ploughed and cultivated in the ordinary way.

Although only one season's records are at present available some extremely valuable and interesting facts emerge from the data thus collected.

Reduction of Soil Losses due to Flatter Ridges.—Unfortunately no area of unprotected land was under observation at Glenara during the season so that no exact comparison can be drawn between the losses of soil from unprotected lands and from lands protected with ridges of varying slopes. American data for unprotected cultivated lands of similar slope and

character to those under observation show, however, that *a loss of not less than 30 tons per acre would have been recorded.*

In the case of the land protected with the ridge on a grade of 1 in 400 it was found that the total weight of soil removed from the whole area of 5.59 acres was 5.10 tons, *i.e.*, 0.91 *tons per acre;* and in the case of land protected with the ridge on a grade of 1 in 1,000 the total weight of soil removed from the whole area of 4.69 acres was 3.14 tons, *i.e.*, 0.67 *tons per acre.*

It will be seen, therefore, that the adoption of the flatter grade ridge resulted in a 26 per cent. reduction in the amount of soil eroded.

When the soil losses from the lands protected with either type of ridge is compared with the losses from unprotected lands, however, such reduction appears negligible and both ridges may be regarded as equally efficacious in reducing soil erosion losses.

The following summary brings out this point clearly:—

	Soil loss tons per acre.	Depth of soil eroded per annum. Inches.	Pediod of years for erosion top 7 inches of soil.
Unprotected land	30	0.2052	34
Land protected with ridge on grade 1 in 400 ...	0.91	0.0062	1130
Land protected with ridge on grade 1 in 1,000...	0.67	0.0046	1520

The depth of soil eroded has been arrived at by accepting the weight of the soil as 90 lbs. per cubic foot.

Reduction of Flood Run-off from Protected Lands.—The following summary shows the run-off that was recorded from each area during the rainfall season:—

Date.	Rainfall. (inches).	1 in 400 Ridge. Total run-off. cu. ft.	1 in 400 Ridge. Percentage run-off.	1 in 1,000 Ridge. Total run off cu. ft.	1 in 1,000 Ridge. Percentage Run-off.
Prior Rainfall	14.74	No run-off.			
29th December	2.26	6,849	14.9	2,196	5.7
30th ,, ...	1.39	6,489	22.9	4,302	18.1
31st ,, ...	0.38	2,259	30.5	180	2.7
2nd January	0.94	918	4.7	72	0.4
3rd ,, ...	0.05	nil	nil	nil	nil
5th ,, ...	0.24	nil	nil	nil	nil
6th ,, ...	0.67	nil	nil	nil	nil
7th ,, ...	0.35	nil	nil	nil	nil
8th ,, ...	0.16	nil	nil	nil	nil
9th ,, ...	0.18	nil	nil	nil	nil
10th ,, ...	1.68	7,017	20.7	2,488	8.7
11th ,, ...	2.22	14,121	31.5	10,525	27.8
12th ,, ...	0.98	3,528	17.9	917	5.4
13th ,, ...	0.05	nil	nil	nil	nil
14th ,, ...	0.36	135	1.8	19	0.3
15th ,, ...	0.66	711	5.3	18	0.1
16th ,, ...	0.04	nil	nil	nil	nil
17th ,, ...	0.49	2,736	27.4	828	9.8
20th ,, ...	1.10	7,632	34.1	4,158	22.1
23rd ,, ...	0.06	nil	nil	nil	nil
2nd-22nd February	1.02	nil	nil	nil	nil
12th March	1.66	157	0.5	nil	nil
16th ,, ...	0.33	nil	nil	nil	nil
17th ,, ...	2.14	2,772	6.4	612	1.7
18th ,, ...	0.84	nil	nil	nil	nil
19th ,, ...	0.24	nil	nil	nil	nil
22nd ,, ...	0.50	nil	nil	nil	nil
23rd ,, ...	0.06	nil	nil	nil	nil
27th ,, ...	0.25	nil	nil	nil	nil
28th ,, ...	0.50	nil	nil	nil	nil
30th ,, ...	0.25	nil	nil	nil	nil
Total	36.79	55,324	7.41	26,315	4.21

It will be noted that there was no flood run-off from either area prior to the 29th December, although a rainfall of 14.74 inches had been recorded by that date, some of which had occurred in the form of heavy storms, notably 2.36 inch on 12th November, 1.36 inch on 24th November 1.12 inch on 8th December, followed by rain on seven successive days totalling 4.82 inches.

It should also be observed that even when the lands were fairly well saturated later in the season, rainfalls of under an inch produced very little run-off, and this effect is still more marked in the case of the land protected with a 1 in 1,000 ridge.

From hydrographic data available for grassed catchments such as the Mazoe and Umwindsi Rivers, it is evident that a run-off of at least 15 per cent. would have occurred with a seasonal rainfall of 36 inches.

In addition, therefore, to checking soil erosion it is apparent that the ridges serve the very useful purpose of reducing flood run-off and thereby conserving moisture in the soil. The 1 in 1,000 ridge was the most efficacious from that point of view, as the run-off was only about one-fourth of what would have been expected from an unprotected catchment covered with grass.

It would appear, therefore, that it would be advantageous to construct ridges of flat grade on cultivated lands in low rainfall areas and in areas with a porous subsoil.

Apart from conserving moisture in the soil by reducing flood run-off, the chemical analyses showed that the flood water leaches out considerable quantities of plant food from the soil and by reducing the flood run-off these valuable constituents are retained to a greater extent.

The data available for one season, therefore, provides concrete facts as to the benefits derivable from contour ridging, and if confirmed by future seasons data may tend to remodel the existing practice in regard to the most suitable grade for contour ridges in certain areas.

At the Matabeleland station, which has been installed this year, the areas under observation have been protected with contour ridges on grades 1 in 1,000 and 1 in 2,500.

CHEMICAL ANALYSIS OF SOILS.

In Tables I. and II. will be found the results of analysis of the soils from the two experimental plots at the time the experiments were first commenced.

Lab. Nós. 524/*F* and 525/*F* represent, respectively, the top 3 inches and *Lab. Nos.* 526/*F* and 257/*F* the top 8 inches of the upper (1 in 400) and lower (1 in 1,000) experimental plots.

In each case numerous samples were taken, mixed, and a representative portion used for analysis.

The surface soil on both plots is a rich reddish-brown loam extending to a depth of from 7—8 inches. The subsoils on each plot are reddish in colour, impregnated with iron concretions, and continue unchanged to a considerable depth.

At the commencement of the rainy season both plots were planted to maize.

TABLE I.—CHEMICAL ANALYSIS.

Hydrochloric Acid Extraction (1 hour's boiling).

Soil Lab. No.	Top 3in. Upper Plot. 524/F.	Top 3in. Lower Plot. 525/F.	Top 8in. Upper Plot. 526/F.	Top 8in. Lower Plot 527/F.
	%	%	%	%
Moisture	3.35	3.31	3.50	3.44
*Further loss on ignition	10.09	10.30	10.26	10.13
Lime (CaO)	0.238	0.280	0.340	0.256
Magnesia (MgO) .	0.402	0.421	0.619	0.403
Iron & Aluminium (Fe_2O_3 & Al_2O_3)	27.07	24.95	25.72	25.19
Phosphoric Oxide (P_2O_5)	0.149	0.147	0.145	0.141
Potash (K_2O)... ...	0.091	0.099	0.099	0.112
*Containing Nitrogen	0.105	0.119	0.112	0.105
†Available Lime (CaO)	0.161	0.200	0.198	0.196
†Available Potash (K_2O)	0.010	0.013	0.010	0.010
†Available Phosphoric Oxide (P_2O_5)	0.0037	0.0041	0.0038	0.0045
pH	5.9	5.9	6.2	6.1

†1% Citric Acid Solution.

TABLE II.—MECHANICAL ANALYSIS.

Lab. No.	No. 524/F. %	N. 525/F. %	No. 526/F. %	No. 527/F. %
Coarse Sand	7.00	5.90	5.32	6.76
Fine Sand...	16.19	19.41	17.69	16.98
Silt...	21.95	25.25	22.96	22.38
Clay...	51.75	46.53	49.37	48.87
Moisture	3.35	3.31	3.59	3.44
Carbonates...	—	—	—	—
Loss by Solution...	.84	.84	.94	.97
Difference...	—1.08	—1.24	.22	.7
Total	100.0	100.0	100.0	100.0

As will be seen from the above analyses, the soils on both plots are very similar in nature, both as regards their chemical and mechanical composition.

In October, 1935, by which time the water which had collected in the tanks had completely evaporated, representative samples were taken of the soils in all the traps and tanks. These soils were subjected to chemical and mechanical analysis, with the following results:—

TABLE III.—CHEMICAL ANALYSIS OF SOILS FROM TRAPS AND TANKS.

	Trap to Upper Tank.	Upper Tank. 1 in 400.	Trap to Lower Tank.	Lower Tank. 1 in 1000.
	%	%	%	%
Moisture	2.75	2.59	2.68	2.61
*Further loss on ignition...	12.66	13.49	12.41	13.55
Lime (CaO)	0.21	0.30	0.33	0.20
Magnesia (MgO) .	0.20	0.44	0.18	0.29
Iron & Aluminium (Fe_2O_3 & Al_2O_3)	23.06	25.32	23.46	24.77
Phosphoric Oxide (P_2O_5)	0.18	0.21	0.22	0.22
Potash (K_2O)... ...	0.11	0.15	0.11	0.14
*Containing Nitrogen	0.16	0.18	0.16	0.19
†Available Lime (CaO)	0.12	0.25	0.12	0.08
†Available Potash (K_2O)	0.017	0.027	0.007	0.015
†Available Phosphoric Oxide (P_2O_5)	0.01	0.016	0.011	0.016
pH	7.4	7.9	7.8	6.9

†1% Citric Acid Solution.

TABLE IV.—MECHANICAL ANALYSIS OF SOILS FROM TRAPS AND TANKS.

	Lower Tank (mean of 3)	Upper Tank (mean of 3)	Trap in Lower Tank.	Trap in Upper Tank (mean of 2)
	%	%	%	%
Coarse Sand	Nil	Nil	Nil	Nil
Fine Sand...	4.25	3.80	10.05	11.08
Silt	29.74	30.39	28.23	31.22
Clay	60.99	61.01	57.50	53.92
Moisture	2.61	2.59	2.68	2.75
CO_3	Nil	Nil	Nil	Nil
Loss by Solution...	1.88	1.65	1.17	1.23
Difference...	+.53	+.56	+.37	.20
Total	100.0	100.0	100.0	100.0

It will be seen that the soils from the lands are all distinctly acid in reaction, the pH's ranging from 5.9 to 6.2, whereas the soils from the tanks and traps are almost neutral or distinctly alkaline, the pH's ranging from 6.8 to 8.0.

The average content of the clay and silt combined of the soils in the fields is 72.27%, that in the tanks 91.07%, and in the traps 85.33%.

It is therefore apparent that the fractions of the soil removed by erosion are mainly composed of silt and clay.

There is a marked increase in the nitrogen content of the soils in the tanks and traps as compared with the field soils, which is probably due to the humified organic matter in the latter soils getting washed away with the silt and clay. As far as the mineral constituents are concerned it will be noted that the phosphoric oxide content of the soils from the tanks and traps is considerably greater than that of the original soils on the experimental areas.

It would therefore appear that the losses of this element by soil erosion may be greater than that indicated by a comparison of the original composition of the soil and that of the soil eroded.

It is of interest that the percentage of phosphoric oxide in the soil collected in the lower tank is no greater than in

the lower trap, therefore it may be assumed that in this case no phosphoric oxide was contained in the water collected and left to evaporate in the tank.

The soil in the upper tank, however, contained a definitely higher percentage than that in the trap, therefore the possibility exists that phosphoric oxide may be lost by solution in the flood run-off as well as being actually contained in the soil complex.

A comparison of the potash content of the soils from the traps and tanks shows that from both areas the soils in the tanks had a higher potash content than those in the traps. This, therefore, indicates that the flood run-off from both areas contained potash in solution and justifies an assumption that this element may also be lost in this manner.

From the data given in this report the actual losses of essential plant food elements may approximately be calculated.

It has been shown that the total weight of soil removed per acre from the upper aıea (1 in 400) was 0.91 tons per acre and from the lower area (1 in 1,000), 0.67 tons per acre.

Taking the analyses of the soils in the traps as given in Table III. the total weight of essential plant foods removed per acre is as follows:—

	Upper Area losses per acre.	Lower Area losses per acre.
P_2O_5	3.28 lbs.	2.95 lbs.
K_2O	2.00 lbs.	1.47 lbs.
CaO	3.82 lbs.	4.42 lbs.
Nitrogen	2.91 lbs.	2.44 lbs.

The losses of plant foods by solution in the flood water may be calculated by taking the differences between the quantities of plant foods contained in the soil in the traps as compared with those in the tanks.

The increased mineral content of the tank soils is probably due to the minerals in solution in the flood water which was collected in the tanks and allowed to evaporate.

As previously explained, the amount of water flowing into the tanks was approximately one-fifteenth of the total flood run-off. The total losses by solution are given in the following summary:—

	Losses by solution from Upper Area 5.59 acre.	Losses by solution from Lower Area 4.69 acre.
P_2O_5	3.3 lbs.	Nil
K_2O	4.2 lbs.	1.5 lbs.
CaO	9.7 lbs.	Nil
Nitrogen	2.1 lbs.	1.5 lbs.

From the above figures it may be taken that the actual amounts of plant food ingredients lost through solution in the flood water are very small and for practical purposes may be ignored. Similarly, on protected areas such as were used in this experiment, the losses of plant foods through eroded soil are not of any material significance. If, however, these losses are considered in the case of unprotected lands, it will be seen that they are by no means insignificant.

This is brought out in the following table, which assumes the amount of soil eroded on unprotected lands to be 30 tons per acre. The figures are calculated on the analysis of the soil in the trap from the upper area.

	Soil loss, tons per acre.	P_2O_5 loss in lbs per acre.	K_2O loss in lbs. per acre.	Nitrogen loss in lbs. per acre.	CaO loss in lbs. per acre.
Unprotected land ...	30.0	108.11	66.07	96.07	126.13
Land protected with ridge on grade on 1 in 400	0.91	3.276	2.002	2.91	3.822
Land protected with ridge on grade on 1 in 1000...	0.67	2.948	1.474	2.144	4.422

It is of interest to note that on the unprotected land the cost of replacing the above amounts of plant foods in the form of artificial fertilisers would, at the present ruling prices of fertilisers in Salisbury, be approximately £4 12s. 0d. per acre.

WEEDS.

CONTROL OF WEEDS ON FOOTPATHS AND TENNIS COURTS.

By S. D. Timson, M.C., Assistant Agriculturist.

Much labour is wasted each year throughout Rhodesia in the removal by hand of weeds from garden paths, tennis courts, and also, it is believed, from the sidewalks in the townships.

A far simpler and less expensive method is ready to hand, namely, the use of sodium chlorate in solution. This is a powerful plant poison, which enters the sap stream of the plant and permeates therein throughout all the tissues.

It is easily applied in the form of a ten per cent. solution (1 lb. per 1 gallon of water) by means of watering cans, or, more economically, by spray pump. It is best applied during bright, dry, periods in showery weather. Two hours only of dry weather are necessary after application to weeds to ensure killing them.

Only a fine covering to the foliage of the weeds is necessary to kill all annuals. Perennial weeds with an extensive underground root stock may require a second dressing (such as Bachelor's Button or Gomphrena, and Bermuda Couch).

A suitable spray pump can be purchased locally for about 22s. 6d.

Sodium chlorate renders soil infertile for a period of about six months to a year, so it must not be applied to soil under cultivation, but this feature is particularly valuable to householders, since at the beginning of the rains paths and tennis lawns may be given a good wetting with a 20 per cent., or even stronger, solution. This will prevent the growth of weeds during the summer very largely, and any that manage to grow can be dealt with by local applications whilst they are young.

Fire Hazard.—Sodium chlorate is a powerful oxidising agent, and when organic matter such as boots, clothing, sacking, etc., are soaked in the solution and dry out, they become extremely combustible, and the ash of cigarettes, etc., may cause serious fires.

This danger is easily avoided by ordinary care in applying the solution, and by thoroughly washing in water clothes, boots, etc., which become soaked in the solution.

No Poison Hazard.—There is no danger of poisoning cats, dogs, or other animals by this method of control of weeds, since sodium chlorate is not an animal or human poison, unless eaten in large quantities. Cattle, for instance, can graze pastures which have been sprayed to kill weeds.

This method of controlling weeds should prove of particular value to municipal and town authorities.

ORGANIC MANURE.

SOME FURTHER NOTES ON COMPOST.

By S. D. Timson, M.C., Assistant Agriculturist.

Considerable interest is already being evinced in this method of manufacturing organic manure on the farm since the appearance of the article on the subject in the last issue of this Journal. The article in question was written against time, and in consequence a number of points of importance were not dealt with. The writer intends, however, to include these points in a further article which will appear in the near future, and he will also give the system of treatment, where the materials can be watered artificially, which allows the manufacture of compost to be carried on throughout the whole year.

One or two points of particular interest, which have been raised by correspondents, may perhaps be considered with advantage at once.

White Ants.—It has been stated that the making of compost manure will be rendered impracticable by the depredations of white ants in those areas where they do much damage in the maize belt. In practice, however, it has been found that the high temperatures generated in the compost heap prevents the ants from working, except in the outside inch or so, and the amount of material they can carry away before the compost is used is negligible. In the writer's experience they do not commence work until the compost is almost ripe.

Withering of Green Materials.—The reasons for the necessity for thoroughly withering all green materials before composting them was not stated in the article on this subject. They are as follows. Green and "sappy" materials tend to "mat" together in the heap, and close up the air spaces; thus preventing the proper aeration of the heap and the penetration of rain. Green materials should be withered for at least two days.

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Amount of Rainfall or Water necessary for Compost Making. —Certain farmers who are anxious to speed up the manufacture of compost this year and are waiting for rain have asked to be informed of the quantity of rain or water which is required to commence and carry through the process.

It has been found at Indore under conditions somewhat similar to those obtaining in this Colony that a total of 16 inches of rain is sufficient to complete the manufacture of rain-watered compost. It was found that 4 to 5 inches of rain supplied sufficient moisture for the process previous to the first "turn." This is equivalent to about 560 to 700 gallons per 10 yard length of a heap, which is normally 3 yards wide; or a surface area of 30 square yards, in other words. It is likely that the higher quantity (700 gallons) will be required in this Colony owing to the drying effect of the almost continual wind.

Between the first and second "turns" about twice this quantity was found necessary, and after the second turn only one or two inches of rain, or 140 to 280 gallons per 30 square yards of surface.

Where rainfall is likely to be deficient it can be economised, and the commencement of rotting hastened, by building the heap only half the height and twice the width. This exposes twice the surface area to the rain, and so only half the rainfall is necessary before the first "turn," when the heap is thoroughly mixed and built up to its normal height and width. This may be done at any time, and it is, for similar reasons, best to do the turning of the heaps on rainy days.

Effect of Errors in Manufacture.—It is comforting to the farmer taking up this process for the first time to know that whatever mistakes he may make in the way of adding too much or too little water, or dung, or urine-soaked earth, or wood-ashes, or in delaying the turning of the heap, he will always in the end obtain practically an identical product. Errors in the manufacture will only delay the process (perhaps by some months), and the farmer can rest assured that the ripe compost will always be of approximately the same composition and value. The percentage of nitrogen and

potash and phosphate will vary to a certain extent, but this is of inconsiderable importance. Furthermore, providing the process is completed there is no possibility of obtaining a material which can be harmful to crops, as is the case with a partly decomposed crop of sunnhemp ploughed under.

In this connection it is of interest to note that the analysis of compost made from scrap tobacco by the writer revealed that it contained practically the same amount of organic matter and of nitrogen as compost made in India from quite different materials. The organic matter was 21.2 per cent. and the nitrogen 0.87 per cent.

Usual Causes of Slowing Down of Process.—Where it is found that the heap does not heat up rapidly or maintain an even temperature it will usually be due to the presence of too much or too little moisture, or to the heap being too much consolidated and thus preventing the free entry of air. The presence of an excess of soil or wood ashes, or of unwithered green materials, will also make the heap too dense and so prevent proper aeration.

If the materials of the heap have an exceptionally low nitrogen content, as in the case of wheat straw, maize stalks, and old dried grass, this will slow down the process. In such cases it can be speeded up by the addition of nitrogen in the form of sulphate of ammonia, which may be sprinkled over each layer as the heap is built, or by the use of increased quantities of animal dung. But this should be avoided by using a mixture of materials high in nitrogen such as sunnhemp and leguminous crop residues, with the materials low in nitrogen, since sulphate of ammonia is an expensive fertiliser and unnecessary, and wasteful. As an emergency measure it may, however, be borne in mind.

Importance of Correct Mixture of Materials.—Nitrogen will be lost during composting if the materials are over rich in this plant food, as is the case with immature sunnhemp. The remedy is obvious; to mix materials low in nitrogen, such as dried mature grass, maize husks, etc.

Where the materials being composted have a low nitrogen content there is always a gain in total nitrogen due to

nitrogen-fixation by bacteria from the air. The growing of sunnhemp on compost heaps also results, of course, in a gain in the total nitrogen.

In the making of kraal manure in Rhodesia very serious losses of nitrogen take place by leaching, whereas *in properly organised composting large gains of nitrogen from the air may be assured*, and loss after the process is complete may be prevented by banking it in the dry soil, by ploughing it under, until the next rainy season arrives. Whilst the soil remains dry no further change can take place and so no loss will occur.

Some Advantages of Composting the Green-manure Crop.—Every year a number of cases are brought by farmers to the notice of the writer of ill results following green-manuring, although in some of such cases the process has gone smoothly and the crop has grown well, been perfectly covered and perfectly rotted down before sowing the following crop.

In many cases this is undoubtedly due to the nitrogen of the green-manure being washed from the surface soil by rain after the crop has rotted down. Practically every farmer has experienced such disappointments if he has been green-manuring regularly for a considerable period.

If the top-growth of the green-manure crop is composted instead of being ploughed under such disappointments would be almost entirely avoided, since compost is only applied to the land when it is in a proper condition for the use of the crop, and losses are thus avoided.

Another trouble solved by composting the green-manure is that the difficulty still often experienced in properly covering the green-manure when ploughing it under is avoided, and the danger of leaving the top-soil too open for the following crop is eliminated.

After the removal of the top-growth for composting the ploughing of the stubble may be left until a convenient time, and until the soil is in the proper condition, and thus it will never be necessary to plough the land when it is too wet with the inevitable evil effect on the tilth as is often the case where a sunnhemp or sunflower crop *must* be turned under, owing to its reaching maturity, or the lateness in the season.

The ploughing under of a green-manure crop is always to a certain extent a gamble, and an unavoidable gamble, on the weather conditions. Excessive rains after ploughing or before planting the following crop, or lack of rain after ploughing will all cause trouble and loss. Where the top-growth is composted this gamble is eliminated.

In fine, in green-manuring there are a number of incalculable factors which are eliminated by composting the top-growth, which practice also increases the crop-producing power of a green-manure crop.

An advantage of composting the green-manure, which is of the greatest importance in Rhodesian farming, would be that a reduction of the acreage under green-manure each year would be possible. At present one-third, or one quarter, of the land is placed under a green-manure crop by the up-to-date farmer in the maize belt, and during this period the land produces no crops for sale or for turning into beef, pork or dairy produce, etc. *By composting the green-manure a reduction of the idle land under green-manure of* 50 *per cent., or more, will be possible.* On the smaller farms this may well be the difference between success and failure, especially when the low ruling prices of almost all farm products are borne in mind.

Why Compost the Green-Manure instead of putting it into the Kraal?—The writer has been asked by some farmers why should the green-manure be composted when it is simpler to place it in the kraal to be turned into manure. They have lost sight of the fact that only a comparatively small and a definitely limited quantity can be accommodated in the kraals on an average farm. Further more, the Rhodesian cattle kraal is a most inefficient factory for organic manure and enormous losses of nitrogen and other plant foods take place by washing and through the ammonia given off to the air.

By employing the cattle dung dropped in the kraal to compost the green-manure crop a very much greater quantity of the latter may be turned into organic manure of at least equal value to the best kraal manure, and with a minimum of loss.

At Indore it has been established that the dung and urine-soaked earth of one ox is sufficient to convert suitable organic wastes into 3,500 cubic feet, or 130 cubic yards of compost. If we take $2\frac{1}{2}$ cubic yards of ripe moist compost as weighing one ton, then *it is possible with the dung from one ox to make 52 tons of compost per annum, which will suffice for the manuring of 8 acres.*

The above figures are based on the actual experience of many years on the Indore farm in India, where careful organisation and long usage ensures the optimum results. Similar results can hardly be expected on the average farm in Rhodesia, but if we take only 50 per cent. of the Indore figures the dung from one ox can reasonably be expected to produce enough compost to manure four acres.

It will be clear therefore that on the average farm, providing sufficient waste vegetable materials and sunnhemp are available, that at least half the acreage could be manured with a dressing of $6\frac{1}{2}$ tons of compost per annum.

If the above estimates are accepted, and the writer maintains that they are extremely moderate, it will be seen that by making compost from farm organic wastes and the green-manure crop, that *the acreage of idle land under green-manure can easily be reduced by fifty per cent. and more,* as pointed out in a previous paragraph.

It should be noted that the above estimates are based on an estimate of four spans (16 oxen each) per 500 acres of arable land under the plough, and no account is taken of any other stock, which are always to be found on every farm.

By composting farm wastes and the green-manure crop, therefore, not only will the proportion of idle land under green-manure be greatly reduced, but the proportion of land receiving a dressing of organic manure each year can be appreciably increased, with the attendant benefits of healthier crops, heavier yields per acre, and reduced costs of production per acre. The resistance of the crops to drought and excessive rainfall will be greatly increased.

It is not suggested that compost will relieve the farmer of the necessity of applying phosphates to his soil, but if combined with a dressing of compost he will obtain far better results from his fertilisers and *vice versa.*

Is Composting the Green-manure Crop Economically Practicable?—The writer cannot yet answer this question himself, though he is firmly of the opinion that it definitely is a paying and practical proposition, and he has just heard from one very successful and progressive farmer, who has been putting the system into practice on his farm in the Mazoe Valley with great success, in a slightly modified form. This gentleman is enthusiastic about composting, and since he keeps careful costings of all his operations his opinion carries great weight.

Another very successful practical farmer has, in an article appearing in the *Rhodesia Herald* of the 28th February, expressed the following opinion. In summing up the question of composting he states: "If a maize farmer made sufficient compost to dress half of his acreage which would normally go down to green-manure each year, he would be keeping so much more land under crops and be thereby getting a bigger return. *It seems practical to me.*" This gentleman is testing the matter on his own farm.

The writer can at least urge every farmer at once to commence testing the value of composting both the ordinary farm wastes and also a mixture of them with, say, fifty per cent. of the top-growth of his green-manure crop, on a moderate scale. Once he has realised the simplicity of the practice and the value to his crops, the writer has little doubt that he will continue and extend his activities as far as he is able in this direction.

The Dehorning of Cattle

INTENDED FOR SLAUGHTER AND EXPORT.

By B. A. Myhill, Assistant Chief Veterinary Surgeon.

Now that the export of meat in the chilled and frozen state from this Colony to markets overseas appears to be well established and likely to continue, thus forming the principal channel for the disposal of cattle by stock owners, the writer feels that the time is opportune, in fact overdue, to bring to the notice of stock owners the absolute necessity for the systematic de-horning of all cattle intended for slaughter purposes.

Owners of cattle, particularly those who feed, suffer considerable financial loss through having portions of the carcases of their cattle which are slaughtered for export purposes, rejected at the abattoirs on account of bruising.

Most of this "bruising" takes place in the feeding pens and the railway trucks and is entirely due to animals poking each other and would to a great extent be eliminated if such animals were without horns, this apart altogether from the unquestionable fact that de-horned animals are much easier to fatten in pens than horned cattle, being quieter and not always fighting and poking each other. They actually fatten much quicker.

Although methods of de-horning adult cattle will briefly be described later on, the purpose of this article is to advocate the systematic de-horning of all slaughter cattle during the early life of the animal; in fact, when they are still very young calves.

At this age the process of de-horning is very simple and inexpensive and the result extraordinarily good provided reasonable care is exercised during the operation.

There are two simple methods for the de-horning of animals in early life.

1. Application of caustic potash pencils.
2. Actual cautery with hot iron.

The object in both methods is to destroy the horn-forming cells before any appreciable development takes place, and thus entirely prevent the growth of horn.

Young Cattle: 1. Application of Caustic Potash Pencils.—This method, in the writer's opinion, is to be recommended above all others, being the simplest, cheapest and most satisfactory.

No instruments beyond an ordinary pocket knife are required, and the caustic potash pencils can now be purchased almost anywhere throughout the Colony.

Age.—The best age is when the calf is from 5 to 10 days old, or as soon as the small horn buds make their appearance, which is usually under a week old.

Restraint.—The calf should either be held in the standing position or it may be thrown, it is immaterial as long as the head is held rigid.

Procedure.—The operation should not be performed in the open in wet weather, as the rain will cause the caustic to run from the wound down the face and into the animal's eyes; other than this weather conditions have no effect.

It is better if the hair immediately around the horn bud is removed by scissors; this is not essential, but the hair must be brushed aside so as not to interfere with the operation.

The horny skin covering the budding horn, together with the small portion of the horn protruding above the level, is removed in one movement with a knife, for which purpose a blacksmith's "searcher" is especially adaptable, but the ordinary pocket knife is quite suitable. Some operators manage without any knife, using their thumb nail only.

A deep scooping or digging cut should not be made owing to the danger of opening into the frontal sinus and also causing excessive haemorrhage, which, although in itself is quite harmless, is to be avoided owing to the danger of excessive moisture caused by the blood overflowing the wound and getting into the animal's eyes whilst the caustic pencil is being applied.

Having made the necessary cut, the caustic pencil is now applied by rubbing the point over the entire cut surface in a rotary manner.

It is important that the entire cut surface be cauterised, otherwise live cells may be left around the edges and later develop into odd shaped horny growths, which although small and harmless, are very unsightly and spoil the appearance of the animal as a de-horned beast.

The caustic pencil is applied until the cut surface becomes a pale glistening white, this effect is usually obtained by rubbing the wound about 15 times—this, of course, is not a hard and fast rule and is only mentioned as a guide to those attempting the operation for the first time.

The astringent effect of the caustic will usually check all bleeding caused by the cut, but great care must be exercised to see that none of the caustic overflows into the animal's eyes or skin surrounding the wound. A ring of vaseline placed round the wound will assist in preventing this.

The caustic on the wound having dried the animal may be freed and allowed open range, provided the weather is dry; if wet the calf must be kept under cover.

If the operation is properly carried out no bad effects result and not a vestige of horn will subsequently develop, and the animal will grow out indistinguishable from polled breeds of cattle.

After the operation the animal should be occasionally examined for the presence of screw worm, and if found, suitable measures taken.

In the ordinary way the surface of the wound becomes hardened and screw worm will not gain access. Occasionally, however, through accident or by the animal rubbing its head against some obstacle, the wound may become opened with resulting haemorrhage, thus attracting flies, etc.

2. **Actual Cautery with the Hot Iron.**—The use of the hot iron is not a new method, but is probably almost the oldest known, however, both the technique and the instruments used have been improved.

Within recent years an instrument known as "Rorke's De-horner," has been put on the market in this Colony and is eminently suitable for the purpose. Most stockowners are familiar with this instrument, so no description is necessary.

The procedure is very similar to the caustic pencil method, except that the hot iron is used in lieu of the caustic.

Age.—Calves should preferably be from 5 to 10 days old, but older animals, up to one month, can satisfactorily be de-horned by this method, but the younger they are the better.

Restraint.—As in the caustic pencil method.

Procedure.—The hair around the base of the horn bud should be clipped.

A knife may be used to cut the horny skin and the tip of the horn, or the skin and horn may be burned away without the previous use of a knife.

Haemorrhage is of no importance in this method, as the hot iron will easily control it. The iron when applied should not be too hot, a dull red is sufficient and the hot iron should only be lightly applied, whilst the process of burning the horn is taking place; if too much pressure is applied, or the iron is too hot, there is considerable danger of opening up the frontal sinuses. As with the caustic pencil, care must be taken that all the horn developing cells are destroyed, otherwise unsightly horny growths will subsequently develop.

Weather conditions need not be considered, the operation can be performed whether it is wet or fine and no ill effects need be looked for except the possible introduction of screw worm.

Older and Adult Cattle.—The de-horning of adult cattle cannot be recommended, the operation is very painful, haemorrhage is excessive and sometimes difficult to control, and unless performed under a general anaesthetic is a very cruel procedure, and should therefore only be attempted by qualified practitioners.

I am very much opposed to the layman attempting to de-horn adult cattle without any form of anaesthetic, and anyone so performing it should be charged with cruelty to animals and heavily punished.

However, it is realised that pending the universal practice of de-horning animals as calves, and even if the procedure were adopted immediately by stockowners, several years must elapse before these animals will be ready for market, during which period mostly horned cattle will be available, some method to minimise the bruising and injuries at present caused by horned cattle, with the resulting economic loss to feeders, must be adopted.

The common practice in vogue to-day amongst feeders in this country is to saw off the tips of the horns, without interfering with the sensitive horn core.

Although not strictly within the meaning of the word de-horning, perhaps the procedure may be briefly described before passing on to the de-horning of adult cattle.

Tipping the Horns.—This method is usually undertaken in cattle with very sharp pointed horns or in cattle that are particularly quarrelsome with their fellows.

A reim or rope is tied round the animal's horns, by means of which the head is hauled up to a tree or suitable fixed object, when the head is held fast by manual force.

As most of the tips of the horn as can be removed without touching the sensitive horn core is then removed by means of a hand saw. Any hand saw is suitable for this purpose.

As the type of horn in individual animals varies considerably, it is impossible to state definitely how much of the non-sensitive point of the horn can be removed, it varies considerably, but usually it is quite safe to remove some 1 to 1½ inches, and in some cases up to four inches.

As only the horny outer covering is sawn, no pain is evinced and no bleeding occurs and the animal can be immediately released.

Adult animals are usually de-horned by either of two methods:—

1. By means of a hand saw.
2. De-horning shears.

1. **Hand Saw.**—Although special de-horning saws are obtainable, these are not essential and any variety of hand saw will suffice, provided it is reasonably sharp.

The animal must be cast and a general anaesthetic administered. The horn is then sawn off as near the base as possible.

Extensive haemorrhage always occurs and must be controlled before the animal is freed; this is best accomplished by the application of cotton wool pads soaked in any suitable disinfectant, such pads are placed on the horn stump and kept in place under pressure by means of a figure of eight bandage applied round the base of the horn stumps.

These pads and bandages may remain *in situ* for three days, when they must be removed and, if necessary, replaced by fresh ones, or if fresh pads are not necessary, the stumps of the horns should be smeared with stockholm tar and the patient turned loose.

Some operators smear the bleeding surface of the horn stumps with the actual cautery before applying the pads and bandage, but this procedure is according to the operator's individual taste.

As bleeding may recur through injury received before the wounds have properly healed, the animal must be periodically examined for this and for the presence of screw worm.

2. **De-horning Shears.**—Various types of instruments known as de-horning shears are manufactured for the de-horning of cattle, most are heavy, cumbersome instruments and require expenditure of considerable physical force in their use. They are also quite expensive, costing from £3 to £10, according to design. The principal of all designs is the same and consists of one or more cutting knives brought into use under pressure, on the bolt cutting principle. The knives are fixed in the head of the instrument and the pressure applied by bringing the handles together. In the larger sizes the handles may be some four feet long fitted with cogs.

To use the instrument the handles are pulled apart, the head of the de-horner is placed over the horn as near the

base as possible, the handles are then pulled together, which closes the instrument and causes the blades to cut into the horn. Continued pressure is applied until the horn is completely sheared through. Haemorrhage similar to that met with in the use of the saw will occur and must be controlled in the same way.

Care must be exercised that an even pressure is maintained, as with any jerky or uneven pressure there is danger of drawing the horn core away from its attachment to the skull, thus exposing a large cavity some two inches or more in diameter leading into the frontal sinuses. Such a wound is difficult to keep clean, and invasion by screw worn and other parasites usually follows. If the frontal sinuses are opened, bleeding via the nose will be encountered which, although not serious, greatly retards healing and causes inconvenience to both animal and owner.

It must be pointed out that instruments such as those just described are not intended for the wholesale de-horning of cattle, but are designed to meet cases of accidental injury to horns necessitating amputation or removal of horns from savage and dangerous cattle. The use of these instruments, in my opinion, holds no advantage over the use of the hand saw.

In conclusion, the importance and necessity of de-horning cattle intended for slaughter cannot be too strongly emphasised, or the fact that they should be done early in life as calves.

Abridged Report on Summer Crops: Season 1934-35.

By The Government Statistical Bureau.

General.—Little damage was done to crops by locusts, insect pests or disease, but as a result of excessive rains at the commencement of the season and the subsequent long dry spell, the yield of most crops in 1934-1935 was lower than in the previous season. The most outstanding decrease occurred in the production of maize, the yield per acre amounting to only 4.76 bags as compared with 7.01 bags in previous season. The Virginia tobacco crop, also, showed a decrease of 5½ million pounds, but was nevertheless the third largest on record.

The following table gives the acreage and actual yield of the two principal crops—maize and tobacco—during the season 1934-1935. The Government Statistician's estimate of both crops differed very slightly from the actual yield:—

Crop.	Acres.	Yield. Bags.
Maize	266,426	1,269,185
		lbs.
Tobacco—		
Virginian—Flue-cured ...	37,650	19,505,820
Fire-cured ...	1,843	960,528
Other	14	6,300
Total...	39,507	20,472,648
Turkish	1,499	733,276
Total Tobacco	41,006	21,205,924

According to the agricultural returns rendered by farmers the number of farming propositions in Southern Rhodesia

showed a substantial increase in the season 1934-1935—3,017 returns being dealt with as compared with 2,952 in the previous season and 2,916 in 1932-1933.

ACREAGE AND YIELD OF SUMMER CROPS.

The total area under summer crops in the season under review, 428,525 acres, was the largest on record and compared with 398,037 acres in 1933-1934. The increase of 30,488 acres was due mainly to greater interest in maize, the area planted to this crop increasing by nearly 20,000 acres.

Maize.—In the season 1934-1935 the area under maize amounted to 266,426 acres as against 246,371 acres in 1933-1934, but the production amounted to only 1,269,185 bags as compared with 1,728,065 bags. The yield per acre —4.76 bags—was the lowest during the last six years, with the exception of the season 1932-1933, when only 4.66 bags per acre were produced.

Tobacco.—The total area under all types of tobacco in 1934-1935 was 41,006 acres, of which 39,507 acres were planted to Virginia varieties and 1,499 acres to Turkish. In the latter case the acreage was slightly more than in the previous season, but the area planted to flue-cured, fire-cured and other Virginia tobacco was less than in 1933-1934. The total production of Virginia tobacco amounted to 20,472,648 lbs. (518 lbs. per acre) as compared with 26,097,888 lbs. (631 lbs. per acre) in the previous season. The bulk of the Virginia crop, 19,505,820 lbs., was flue-cured, 960,528 lbs. being fire-cured and 6,300 lbs. other varieties of Virginia tobacco. The production of Turkish tobacco amounted to 733,276 lbs. as compared with 694,204 lbs. in the previous season, and the yield per acre to 489 lbs. per acre in 1934-1935 and 488 lbs. in 1933-1934.

Ground Nuts.—The area planted to ground nuts varies somewhat from season to season. In 1934-1935 there were 6,609 acres planted as compared with 7,109 acres in the previous year, but the yield, 49,423 bags (7.5 bags per acre) was much lower than in 1933-1934, when it totalled 76,020 lbs. (10.7 bags) per acre.

Potatoes.—The acreage, production and yield per acre of potatoes was rather less in 1934-1935 than in the previous season 1,783 acres yielding 54,197 bags of potatoes (34.0 bags per acre) as compared with a production of 64,572 bags (35.8 bags per acre) from 1,801 acres in 1933-1934.

Sweet Potatoes.—The area planted to sweet potatoes totalled 1,246 acres, 545 acres more than in the previous season. A crop of 20,568 bags was obtained, giving a yield per acre of 16.5 bags. In addition 198 acres of tops and tubers were fed direct to stock.

Sunflowers.—An area of 7,352 acres planted to sunflowers yielded 31,425 bags, or 4.3 bags per acre. In the previous season the yield per acre amounted to 4.5 bags. In the season under review 1,020 acres of sunflowers were fed direct to stock and 8,997 acres were ploughed under for purposes of green-manuring.

Cotton.—There was a substantial increase over the previous season in the acreage under cotton in 1934-1935, the area planted to this crop amounting to 4,610 acres. Owing, however, to deficient rains when the bolls were forming and to the ravages of boll worm the crop was poor, only 696,139 lbs. of seed cotton being delivered to the ginnery as compared with 818,022 lbs. in the previous season. The yield per acre, 151 lbs., compared unfavourably with previous years.

Sunnhemp.—The popularity of this legume as a green-manure crop continues, the area planted for this purpose increasing from 31,796 acres in 1933-1934 to 32,532 acres in 1934-1935. A similar area, 4,032 acres, was planted for seed than in previous seasons, and the production amounted to 5,150 bags, or 1.3 bags per acre.

Beans and Peas.—The area under edible beans totalled 3,525 acres; velvet beans, 857 acres; cowpeas, 2,517 acres; and under dolichos beans, 455 acres. In each case the acreage was larger than in the previous season, and the yield per acre, although decreasing slightly, did not compare unfavourably with previous year.

Tea.—The output of tea continues to expand, and during the past season 85,425 lbs. were produced from 314 acres

which have come into bearing, while an additional 115 acres were not at a productive stage in the season under review. In 1933-1934 the yield amounted to 51,637 lbs.

Coffee.—The area under this crop remained unchanged at 135 acres, but the yield increased from 17,457 lbs. to 20,878 lbs., further areas having reached a productive stage. The yield per acre, however, at 235 lbs. was lower than in the previous season (282 lbs. per acre).

Green-Manure Crops.—The area under green-manure crops (including "trap" crops) which amounted to 48,112 acres, showed an increase of nearly 2,000 acres. There were 36,690 acres planted to leguminous and 11,422 acres to non-leguminous crops. The principal green-manure crops used in the season 1934-1935 were sunnhemp (32,532 acres), sunflower (8,997 acres), cowpeas (2,593 acres), velvet beans (1,266 acres) and amber cane (1,054 acres).

Maize Silage.—The area planted to maize silage, 13,392 acres yielded 38,040 tons, while a further 13,469 tons of tops were cut from the grain crop. In the 1933-1934 season 12,199 acres produced 42,888 tons of maize silage and 11,765 tons of tops were cut.

Mila Maize.—During the season under review small experimental crops of mila maize were grown, 83 acres producing 308 bags, or 3.7 bags per acre.

Vernalization Plants.

The idea of vernalization originated as a result of a new outlook on plant growth and development formulated by the Odessa school of plant physiologists headed by T. D. Lysenko. Until 1930 it was unknown to wider circles of agriculturists, though since that time it has assumed a very prominent place in agricultural literature and thought. The general principles of the theory are now widely familiar. These are roughly that the growth and development, far from being identical as has been popularly supposed, are in reality two distinct and separate phenomena. Growth is regarded merely as increase in size and weight and such changes as flowering and reproduction are included under development. According to the new theory either of these two processes may proceed independently of the other, so that we may be faced with the extraordinary case of a plant which comes into flower without having grown or a plant which grows for ever without ever coming into flower. All that it is necessary to do, it would seem, to produce such remarkable behaviour, is to treat the plant in such a way that one of the two processes is favoured to the exclusion of the other. If seeds of winter wheat are germinated in an ice box and subjected to suitable conditions of light, aeration, humidity and other factors, they can be sown in spring and will come into ear at the same time as if they had been sown in the ordinary way in autumn. Hence the term "vernalization," which is a latinized equivalent of the Russian word "Jarovizacija" coined by Lysenko to describe the phenomenon and which strictly means "transformation of winter forms into spring."

The matter was first brought to the attention of English-speaking readers by a bulletin issued in 1933 by the Imperial Bureaux of Plant Genetics. This early bulletin gave a

complete outline of the method as it was described in Lysenko's first publications, and consisted mainly in the description of a practical method for the pre-sowing treatment of seed to obtain this accelerated development in a variety of crops. This method was rapidly seen to be of practical importance not merely in Russia but in all parts of the world. In view of the wide interest taken in the subject the Imperial Bureaux have continued to collect the literature relating to it. This has assumed such magnitude and the subject has become so much extended in its range that the whole matter has been reviewed afresh in a new and much enlarged bulletin covering some 150 pages, obtainable from the Imperial Bureaux, School of Agriculture, Cambridge, price 10s.

This new bulletin describes in detail the results of the many experiments that have been carried out on all sorts of crops under every possible condition, both in the Soviet Union and in other countries all over the world. The results of vernalization of over 6,000 varieties of wheat and of 500,000 hectares of vernalized sowings, based on replies to a questionaire received from 1,056 different Soviet farms, are reported. The results have on the whole been satisfactory when the necessary conditions of technique have been observed and it would seem that the method may now be definitely regarded as a useful agricultural measure in countries where early ripening is a decisive factor in successful cultivation. For instance, spinach, sugar beet and even potatoes have by suitable treatment been grown at Hibiny in the Arctic circle. Cereals have been induced to ripen a week or more earlier, and by this means it has become possible to extend their cultivation to large tracts of country where this has been impossible hitherto because of drought or other unfavourable conditions. The main results of the Russian workers have now been confirmed in most countries where vernalization has been tried. In countries of more normal climatic conditions the method will probably not be of such wide application to the main crops, but in the case of salad, vegetable and market garden crops a difference of a few days may prove of tremendous economic importance and a considerable future is foreseen in the application of vernalization to plants of this type. The Russian workers have even claimed to get increased yields

from vernalized sowings, but there seems to be some difference of opinion on this point, and others have observed a depression in yield after vernalization.

At least half the bulletin is devoted to the physiological aspect of the phenomenon of vernalization. Lysenka's original conception has been extended to cover the whole range of plant development, in the form of the theory of Phasic Development. Development, says Lysenko, consists of a series of stages, each of which requires for its completion a definite combination of external conditions. The conditions for one phase may be different from those required for others, temperature being the decisive factor for the first stage and light for the second. Each stage must be completed before the succeeding one can be initiated, but once any stage has been completed there is nothing to prevent the progress of the following one, provided the necessary external conditions are forthcoming. The method of vernalization therefore consists in the provisions at as early a point in the life of the plant as possible of the requisite conditions for all the developmental stages leading up to reproduction, thus curtailing the long periods of time that normally occur between these successive stages. A freshly germinated seed has been found to be the most suitable material to work on, as this can be conveniently treated before sowing and then sown in the ordinary way.

Other Soviet botanists, though agreeing with Lysenko's general findings, disagree with many of his conclusions and have put forward theories of their own. The views of these other workers are presented in the bulletin side by side with those of Lysenko in a spirit of pure impartiality. In fact, a careful study of this bulletin shows that it has dealt with the available information from all possible points of view, equally generous treatment being given to the practical application of the method in agriculture and horticulture and to its theoretical explanation. It will be of interest to plant physiologists, biochemists, plant breeders, teaching botanists, and indeed, to anyone concerned with modern trends of botanical and agricultural research. "The rapid development in scientific research is one of the outstanding features of the Twentieth Century," as Sir David Chadwick aptly remarks

in his foreword. "Research workers need the earliest possible information of developments affecting their line of study, but frequently find themselves baffled by its volume and by linguistic difficulties." To overcome these difficulties the Imperial Agricultural Bureaux were organised in 1929 and the bulletin under review affords an admirable example of how these Bureaux fulfil their function. The large majority of the articles with which the bulletin deals are written in Russian and would have remained entirely unknown to the rest of the world if they had not been made available in the present form. A total of over 200 separate articles are considered and reviewed in detail and large sections of the tabulated results of the authors are reproduced in a review of the work of the whole world on this controversial but entrancing new subject.

Soil Erosion in Tropical Africa
AND PROBLEMS CONNECTED WITH IT.

By H. C. Sampson, C.I.E., F.L.S.

The losses caused by soil erosion in depleting the fertility of the land is a subject which in many parts of the world has attracted much attention during recent years, but probably nowhere has erosion been such a constant menace to agricultural development as it has been in tropical Africa.

Botanic research has shown that many of the annual crops common throughout the tropics of the Old World are of African origin, such as the majority of the sorghums, the grain pennisetums, the cowpea, sesame and, probably, the pigeon-pea and the finger-millet. Other cultivated crops are peculiar to tropical Africa, such as the Bambara groundnut and the West African species of cultivated yams and of cultivated rice. It is thus evident that tropical African agriculture must date back for thousands of years. In spite of this, the people of this region have never developed a permanent agriculture, but have always depended on shifting cultivation. There can be little doubt that this state of affairs has been due largely to soil erosion, mostly sheet erosion, which rapidly reduces the fertility of the land, when this is depleted of its natural vegetation either by cultivation or by grazing with stock.

The soils of tropical Africa are much more liable to disintegrate than are those in other parts of the tropics. There is a preponderance of sand present in most of them, and one seldom sees a soil which is sufficiently heavy to crack when it is dry. The only places where these are met with are where the finer particles, washed out of the soil by sheet-flow, have collected in low-lying areas or where these have been deposited as aluvium. Otherwise, the surface soils compared with those of other parts of the tropics are extraordinarily light and very likely to be affected by sheet-flow

as well as by gully erosion. In nature the surface soil is protected by ground vegetation, but as soon as this is disturbed, either by cultivation or by too close grazing, rain causes the soils to disintegrate and erosion immediately commences.

The peoples of tropical Africa are primarily agriculturists. They can be divided into two main categories—namely, the pastoral people, who own cattle, and the agricultural people, who do not. The pastoral tribes seldom take any direct interest in the cultivation of the land, but live on their flocks and herds and on such wild plants as nature provides. They are, from their mode of living, a more aggressive and warlike people; for they not only have to defend their stock from wild animals, but, being nomadic, they have to assert their ownership to grazing areas, water-holes, etc. As their herds have increased, they have extended their boundaries in search of new grazing areas, and have thus frequently replaced agricultural tribes. Sometimes this has been their undoing, as they have run into tsetse-fly areas and, having lost their cattle, have been forced to become indifferent cultivators. Until the coming of the white man, the only restriction to their expansion has been the presence of tsetse fly and the existence of high forest or other types of vegetation where grazing facilities do not exist. Thus the agricultural tribes are, as a rule, located in areas where natural grazing conditions are unattractive, and much of the area occupied by them is, or has been, fly country. Such areas include also riverside alluviums, areas where the tree vegetation is too dense for pasture grasses to thrive, areas where high coarse grass, unsuitable for grazing, dominates the ground vegetation, and areas where the rainfall is too heavy for stock to thrive. It is extremely seldom that one finds a combination of stock-raising and tillage. There are a few examples, such as the case reported by Staples, where on one of the densely populated islands in Lake Victoria the people keep cattle for supplying manure to their cultivation. Around Karonga, at the north of Lake Nyasa, the cultivating tribes keep cattle, and at Taveta at the foot of Kilimanjaro, also, a few cattle are owned. These are always kept tied in darkened huts, as it is a fly area. In

West Africa from the Gambia to Nigeria the cultivating tribes, dwelling in fly areas, keep a few cattle; these belong to humpless breeds and are said to be immune to trypanosomiasis. It is only when one gets out of the tropics in South Africa that one comes across any real traces of a combination of stock-raising and arable farming among the native tribes. Many of the agricultural tribes in tropical Africa do, however, keep small livestock mostly goats and occasionally sheep.

Both these types of farming are responsible for erosion. In times past the numbers of cattle maintained by pastoral tribes were kept down by inter-tribal wars, stock raiding, and by disease, but European Administrations have done much to destroy these agencies for restricting grazing. As far as East Africa is concerned, over-stocking and consequent soil erosion have become perhaps the most serious problem of administration, and unless overstocking is checked, erosion seems likely to destroy these people whose existence is solely dependent on their livestock. In many places the grass cover of the land has now been entirely destroyed and there exists only scattered, useless ground vegetation. In the dry season the surface of the ground is completely broken up by the feet of the animals seeking for something to eat, so that when concentrated rain falls, as it does in these dry grazing areas, the water, unable rapidly to penetrate the dry ground, rushes off the surface, often carrying with it the whole surface soil. In places, conditions have become so bad that there is no possibility of the natural regeneration of the grass flora, as no grass is left to form seed for reseeding the area. The only plants which survive are those which stock avoid, such as thorny acacias, ground succulents, *Cassia* species, etc., and these are rapidly dominating the flora of such regions, which are fast becoming deserts.

Evidence exists to show how rapid this deterioration is. Chapter X., Part III., of the Kenya Land Commission Report is devoted to this subject of overstocking, and gives numerous examples of large areas where desert conditions have succeeded what even twenty years ago were rich grazing areas. It is pointed out also that, though the numbers of cattle owned by these pastoral tribes have doubled within the

last twelve years, yet such is the miserable condition of these animals that the products of this industry have actually decreased. It might be suggested that the solution of this trouble could be found in turning the attention of the people to the cultivation of the land, but as conditions now are, any such attempts would be wasted, because, when rain falls, so rapid is the run-off that water has not time to penetrate into the ground.

Much has been written about the evils of shifting cultivation in depleting the fertility of the land, but the effects of this are as nothing compared with the havoc which can be wrought by overstocking.

The agricultural tribes can scarcely be blamed for the established custom of shifting cultivation. Under the present distribution of population, these people are entirely dependent on the existing fertility of their cultivated plots, and without manure there must come a time when the land will cease to yield sufficient produce to warrant cultivation. Their resources for manuring the land are practically non-existent. They do not own livestock sufficient to produce manure, and the only method they know of manuring the land is to cut and burn the vegetation when they are making a new clearing. Thus a system has been evolved of allowing the land to revert to bush growth, so that it can recuperate, while a new area is cleared and burnt for future cultivation, till that in its turn is temporarily exhausted. Much of the surface soil of Africa being very sandy, when it is depleted of its natural cover the finer particles are very apt to be washed away or washed deeper into the ground, thus leaving the surface soil in a greatly impoverished condition. The natives, although frequently blamed by Europeans for their habit of shifting cultivation, are extremely good judges of land, and close observation will show that they do not abandon a clearing until forced by necessity to do so. Where soil conditions are really favourable one finds conditions which closely approximate to permanent occupation of the land, as, for example, on the red soils of North Kavirondo and of Kikuyu in Kenya, where the density of population is as high as it is on similar types of land in countries where a permanent and highly developed system of agriculture is in

existence. It is, however, very noticeable that the land occupied by the two tribes of these areas is strictly confined to a single type of soil. Again, on level river alluviums one finds conditions approaching permanent occupation of the land. Village sites are much more permanent and land is rested for only short periods. It often seems as if the land is abandoned more on account of too heavy a weed growth than from soil exhaustion. Such land seldom reverts to a bush fallow, as on account of continuous cultivation, tree vegetation has ceased to exist, but it grows a succession of useful weeds, which appear to check the growth of the more objectionable species and thus again render the land fit for cultivation.

Bush fallows play an important part in the agriculture of these people. It really amounts to a rotation of cultivation and bush, the latter being allowed to grow so that the fertility of the land can be replenished. Tree and other wild vegetation can draw on the deeper soil levels for their sustenance, at the same time adding humus and plant food to the surface soil and checking further erosion. Although the lands of a village are generally communally owned, it is the tribal custom among many of these people to recognise the rights of individuals, and if an area has once been cleared, the native responsible for the clearing is entitled to regard that area as available for himself for future cultivation.

Even when making a clearing, the cultivator is careful not to destroy tree vegetation. Any trees in the area are either coppiced or pollarded—the practice varying in different regions—this being done to ensure that the trees are not killed. After weeding the crops, one often notices that the weeds are piled up around such trees, thus assisting them to recover from the removal of their crowns, and otherwise protecting vegetation. This must to some extent check surface wash from the cultivated plot.

Methods of cultivation also are frequently designed to check erosion. Doubtless many of these have now become customary and their origin is lost in the past. The practice of throwing the land up into mounds and of growing the crops on these mounds is common throughout tropical Africa; sometimes this is combined with the inversion of the soil so thrown

up, so that any ground vegetation is buried. This helps to hold the mound together during the first season of the clearing, besides adding vegetable matter for the formation of humus. The presence of these mounds checks the flow of surface water and allows it to soak in, instead of running off and carrying with it much of the goodness of the land. In some areas this practice has been improved upon. Instead of mounds, ridges and furrows are made along the contour, and these are broken so that each furrow catches the water that falls on the ridge and thus prevents wash. In Southern Nigeria, where there is a fairly heavy rainfall and an extended rainy season, these ridges and furrows may be quite large and involve a considerable amount of labour. In the drier parts of West Africa this ridge-and-furrow system of cultivation is generally adopted, and the local hoes are specially adapted not only for making ridges but for inverting the soil on to the ridge. These mounds and ridges when once made are more or less permanent as long as the clearing is in cultivation, and thus they become consolidated; all that is required is to make them up again at the sowing season. Experiments carried out in Nigeria go to show that this is a sound practice, for though these old mounds or ridges may not give quite so much produce, the cost of repairing them is very much less than would be the cost of remaking them. These few examples show that the natives fully realise the losses caused by erosion and consequent soil exhaustion, and their methods are well worth studying not only for themselves, but as a guide to those who seek to improve on them.

Such methods of shifting cultivation answer well enough as long as the population can be kept within reasonable limits. In former times the population of these agricultural tribes was kept down by raiding for slaves, and in some parts of Africa vast areas were depopulated, which have never recovered to this day. Disease also played a considerable part in checking increases in population. Smallpox, for example, still levies a very heavy toll on life if no protection is afforded, and, though the African does not appear to feel the effects of malaria as the European does, there is no doubt that infant mortality is very severe from this cause. Under European administrations slave raiding has been abolished and internal strife has been checked. Health services are doing much to

fight disease and to change the present insanitary habits of the people, and the result which is bound to follow is an increased and more healthy population. Already in many parts of tropical Africa the pressure of population on the land is being felt, and the tendency is for the periods of bush fallow to become shorter and shorter. In order to increase the trade and prosperity of the country, the agricultural tribes are being encouraged to grow crops for export; thus larger areas are being cultivated than formerly were necessary when the only consideration was to supply food for local use.

An extensive literature has arisen in recent years, dealing with methods of checking soil erosion, but many of these methods are only applicable where large areas have been cleared. Some involve considerable capital expenditure and therefore have no appeal to the native, whose plot of cultivation is small and who has no title to the land which he is cultivating.

The problems therefore facing the Administrations of these countries are many. Is it possible to introduce a system of land ownership? Is it possible to bring land under permanent cultivation? Is it possible to create a demand for cattle both for work and for manure among the agricultural tribes, so that a valuable market can be found for the surplus stock of the pastoral tribes? Is it possible to convert the pastoral nomad into a settled agriculturist?

The Agricultural Department in Nigeria has been the pioneer in trying to answer some of these questions. In the southern part of that country, where the rainy season is extended and where agricultural soils exists, it has been proved that land can be kept under permanent cultivation and in a high state of production by the practice of introducing green manure crops into the rotation. The work has been summarised in a Bulletin issued by the Department (*3rd Spec. Bull. Agric. Dept. Nigeria*, 1931), and there is no need to deal with the subject in detail here. The problem which now confronts the Department is to modify the methods employed so that they will appeal to the native. At present the additional labour involved in the cultivation of green manure crops renders it difficult to introduce these

methods into native agriculture. In the dry northern parts of Nigeria such a practice is impracticable, as the rainy season is not long enough to grow a food and a green manure crop in the same season. In this region, however, cattle can be maintained, and advantage has been taken of the fact to demonstrate the possibility of small mixed farm holdings. Remarkable results have been achieved. Individual cultivators have been supplied with a nucleus stock of working and breeding cattle and provided with a suitable area of land. The manure from the stock is used to maintain the fertility of the land, and the area cultivated with the aid of draught cattle is sufficient not only to maintain the smallholder and his family but to enable him to repay the initial cost of the animals supplied to him. Great progress has been made in establishing these holdings, and in this work the Native Administration has heartily co-operated in financing them and in assisting to stock the holdings. Here, as elsewhere in Africa, the cattle of the country are owned by pastoral tribes, who, in the first instance, showed the usual disinclination to part with their animals; now, however, they are finding a ready market at remunerative prices for their surplus stock. The striking feature about this work is that the interests of the individual are the primary consideration. In other parts of Africa the introduction of ploughs and the utilisation of cattle for ploughing have been an important part of the work of Agricultural Departments, but there is nothing to show that any attempt has been made to utilise their introduction to improve the individual status of the people and to render the land cultivated permanently suitable for cultivation. In fact, the rapid increase in ploughing and in the area ploughed is in some places causing alarm. It merely enables larger areas to be grown temporarily with commercial crops, and the inevitable result is more serious soil erosion and a shortening of the period of bush fallow.

The introduction of draught cattle into the agricultural practice of Africa must, however, be a slow process. At present it is only feasible in areas free from tsetse fly, but as the work of exterminating the fly progresses, doubtless new areas will become available. Probably the only method of preventing them from again becoming fly-infested areas is the

development of a native system of mixed farming. One finds that in areas where there is now dense European settlement, and which were previously fly-infested, the fly has now disappeared, and the same result is probable if the problem of settling natives on cleared areas is tackled in the right way.

If the benefits which tropical Africa derives from European influence are not to be ephemeral, the present exploitation of the fertility of the land, whether by agricultural or pastoral tribes, must be checked. Research should concentrate on problems such as those briefly referred to in this article, and the closest co-operation possible between the Departments of Agriculture and Animal Husbandry and the Administrative Service must follow if the results of such research are to be of any material value in checking the huge capital losses now being incurred.—(*Empire Cotton Growing Review*, Jan., 1936.)

SOUTHERN RHODESIA.

Locust Invasion, 1932-36.

Monthly Report No. 38, January, 1936.

A few large swarms of the Red Locust (*Nomadacris septemfasciate*, Serv.) are still active in the Colony, having been reported from the following districts:—Salisbury, Mazoe, Charter, Marandellas, Lomagundi, Nyamandhlovu, Darwin, Bikita, Gwelo, Mtoko, Insiza, Hartley, Makone, Inyanga, Belingwe, Gutu, Chibi, Gwanda and Victoria. Most swarms were described as "large" and "very large."

Seven reports of egg-laying have been received, all from the Mazoe district, but on the 21st second stage hoppers were located and destroyed in the Mtoko district.

No disease has as yet been recorded amongst the specimens examined. Swarms in Inyanga district were reported to be infested with maggots. Birds were reported to be following one swarm in thousands in one district.

One instance of injury by a winged swarm to native-owned crops was reported.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

DECEMBER, 1935.

ANTHRAX.

An outbreak occurred in a fenced paddock on the Bulawayo Commonage. Mortality 19, the incontacts are being inoculated.

TUBERCULIN TEST.

Eight bulls were tested upon importation with negative results.

MALLEÏN TEST.

Three horses were tested upon entry. No reaction.

IMPORTATIONS.

From the Union of South Africa.—Bulls 8, horses 3, sheep 1,400.

From Bechuanaland Protectorate.—Sheep 55, goats 55, pigs 25.

From Portuguese East Africa.—Pigs 25.

EXPORTATIONS—MISCELLANEOUS.

To the United Kingdom in Cold Storage.—Chilled beef quarters, 5,304; frozen boned beef quarters, 75,866; frozen pigs' carcases, 89; tongues, 6,658 lbs.; livers, 6,880 lbs.: hearts, 5,915 lbs.; tails, 1,552 lbs.; skirts, 2,295 lbs.; shanks, 4,509 lbs.; kidneys, 467 lbs.

MEAT PRODUCTS.

From Liebig's Factory.—Corned beef, 28,800 lbs.; sinews, 12,933 lbs.; hair, 842 lbs.

From Rhodesia Export & Cold Storage Co., Ltd.—Beef fat, 6,097 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon

Southern Rhodesia Weather Bureau.

JANUARY, 1936.

Barometric Pressure.—The mean monthly pressures were somewhat below the normal values.

Temperature.—Mean temperatures were distinctly above normal in the south-eastern districts, but normal elsewhere. The highest maxima were recorded during the first four days of the month, and the lowest minima about the 23rd.

Rainfall.—Good general rains were experienced in most parts of the Colony during the first three weeks of the month, owing to the favourable development of the Equatorial low to the west.

The extreme south had practically no rain till the 18th, when the low was centred in the Limpopo basin. During the latter part of the month high pressure systems were predominant, and only scattered showers were experienced in the Colony.

JANUARY, 1936.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.										Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	104	55	91.0	70.1	80.5	77.2	80.1	70.2	61	65	..	4.68	5.80	8	...
Beitbridge...	960.5	...	109	60	93.8	73.9	83.8	...	81.4	71 4	63	67	5.3	3.90	2.64	4	1,500
Bindura...	889.1	...	91	54	82.4	64.5	73 4	. .	71 3	65 0	72	62	5.8	2 83	7.46	12	3,700
Bulawayo	866.2	866.5	91	49	82.8	60.5	71.6	71.4	70 0	62.1	66	58	6 7	4.09	5.72	14	4,426
Chipinga	889 8	...	91	49	78.4	61.4	69.9	..	71.6	64.8	72	61	5.4	11.37	10.17	13	3,685
Enkeldoorn...	855.5	...	91	48	79.7	59.4	69.6	70.2	68.3	61 9	71	58	5.0	6.37	7.14	13	4,788
Fort Victoria	892.4	893.2	100	51	85.2	64.4	74.8	72.3	73.0	65.3	68	62	4.5	3.16	6 43	13	3,571
Gwaai Siding	901.6	...	97	51	86.6	63.2	74.9	...	72.4	65.2	69	62	5.9	5.55	6.91	11	3,278
Gwanda...	903.4	...	97	54	86.3	65.7	76.0	...	73.3	65.6	68	62	5.8	6.12	5.75	11	3,233
Gwelo	860.2	...	93	43	81.4	60 8	71.1	71.4	68.9	61.8	69	58	5.7	5 81	5.98	15	4,629
Hartley...	883.2	...	91	49	82.1	61.6	71.9	73.3	71.0	64.4	71	61	4.5	5.39	8.13	14	3,879
Inyanga...	834.8	...	85	47	75.6	56.3	65 9	...	66.6	60.4	71	57	5.4	8.38	9.52	18	5,514
Marandellas	835.7	...	85	46	76 8	56.1	66.5	...	65.6	59 9	73	56	6 5	8.01	8.66	14	5,453
Miami	876.8	...	88	55	79.3	62.0	70.7	...	69.2	64.2	77	62	6.7	5.53	9.10	18	4,090
Mount Darwin ...	905.2	...	93	53	82.3	63.9	73.1	...	72 1	67 2	78	65	6.2	6.72	8.34	16	3,179
Mount Nuza	800.4	...	78	43	66.3	53.6	59.9	.	59.0	55.7	84	53	7.1	10.26	...	17	6,668
Mtoko	874.9	...	90	52	81.1	62.7	71.9	...	70.5	65.2	76	62	5.1	5.38	8.13	16	4,141
New Year's Gift. .	...	...	100	52	85.2	63 0	74.1	...	73.3	67.2	73	64	...	8.80	8.25	13	2,690
Nuanetsi	958.0	...	109	58	93.1	70.5	81.8	...	80.6	71.7	66	68	4.1	5.34	4.26	10	1,581
Plumtree	862.0	...	92	...	82.0	62.2	72.1	.	71 2	62.1	62	56	3.6	3.29	6.30	15	4,549
Que Que	879.5	...	96	50	83.5	62.4	73.0	...	70.8	63.7	69	59	5.8	7.31	6.86	11	3,999
Rusape	860.0	...	87	49	78.4	58.8	68.6	...	66.3	61 6	78	58	5.6	6.14	7 98	13	4,648
Salisbury	852.5	852.8	86	48	79.7	59.1	69.4	69.3	69.3	62.3	69	58	7.0	5.22	7.36	16	4,885
Shabani...	907.3	...	97	54	86.1	65.4	75.8	...	74.1	67.1	71	64	5.3	7.75	6.02	18	3,131
Sinoia	886.1	...	91	50	82.8	62.0	72.4	...	71.1	65.2	74	62	3.9	4.06	8.10	16	3,795
Sipolilo	882.9	...	89	53	80.0	62.2	71.1	...	72.3	66.3	67	63	5.3	4.94	8.85	16	3,876
Stapleford	840.0	...	84	40	72.9	54.1	63.5	...	64.5	60.0	79	57	6.6	9.72	18.77	18	5,304
Umtali...	890.2	890.9	94	51	82.6	61.3	72.0	71.9	70.5	65.1	76	62	6.3	7.61	8.35	12	3,672
Victoria Falls... ...	...	...	...	...	...	...	...	...	...	...	...	..	...	5.65	7 54	15	2,990
Wankie	924.5	...	102	59	90.3	68.9	79.6	...	76.4	68.0	67	64	6.1	6.92	6.04	15	2,567

Rainfall in January, 1936, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
1	18	20	44	10	...	...	...	1	...	7	6	19	...	73	20	57	31	108	11	1	...	...	...	...	..	...	6	9	2	1	28	472
2	30	32	30	...	...	...	1	2	23	15	2	33	...	143	48	33	17	33	57	36	3	...	...	...	.	...	...	...	1	19	1	559
3	...	58	9	...	...	...	29	46	19	...	...	...	...	171	16	69	3	...	272	172	25	1	7	...	...	...	...	...	.	...	16	913
4	17	6	29	1	...	...	...	44	9	28	2	...	13	88	89	37	6	33	84	8	3	...	. .	..	...	...	.	1	...	17	63	578
5	26	2	31	43	3	13	12	4	41	26	13	8	4	106	16	47	61	50	...	...	...	...	...	. .	...	...	...	4	...	2	17	529
6	17	38	23	2	2	...	...	31	29	14	11	...	19	56	35	25	36	33	82	...	7	...	...	...	...	.	.	...	. .	6	49	515
7	38	37	19	...	2	...	14	74	31	2	...	...	14	82	40	64	6	24	133	30	11	...	...	...	...	...	...	...	...	1	8	630
8	4	32	31	2	2	...	11	87	33	1	...	..	30	91	13	43	36	27	46	10	7	...	...	34	. .	.	.	.	...	5	19	564
9	...	21	56	21	14	7	16	37	11	1	11	4	8	60	16	30	73	39	55	1	15	4	...	32	25	...			..	10	8	575
10	63	1	...	76	6	1	51	53	97	1	...	28	1	31	5	51	3	55	11	6	14		...	16	...		...		..	...	35	605
Mean	22	21	32	16	3	3	9	26	25	12	6	11	7	86	31	43	34	50	51	11	6	1	...	6	3		1	2	1	7	23	549

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No. 654. Root Gallworm or Root Knot Eelworm (Heterodera radicicola, Greef), by Rupert W. Jack, F.E.S.
No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
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No. 714. Trap Cropping against Maize Pests, by Rupert W. Jack, F.E.S., Chief Entomologist.

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No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 742. What is Diplodia in Maize? An Answer to a Popular Question To-day, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.

No. 747. Mycological Notes: (1) Seed Treatment for Maize against Diplodia; (2) Seed Treatment for Tobacco against Bacterial Diseases. Issued by authority of the Minister of Agriculture and Lands.

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No. 788. A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.

A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist. Supplement No. 1.

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No. 798. The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 804 Locusts in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

No. 825. Some Common Diseases of Potatoes in Southern Rhodesia, by by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist. Pathologist.

No. 847. The Lesser Tobacco Wireworms, by Rupert W. Jack, Chief Entomologist.

No. 848. Mycological Notes: Seasonal Notes on Tobacco Diseases—3, Frog Eye; 4, White Mould; by J. C. F. Hopkins, B.Sc. (Lond.).

No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.

No. 856. A List of Plant Diseases occurring in Southern Rhodesia, Supplement 2, by J. C. F. Hopkins, B.Sc. (Lond.), Government Plant Pathologist.

No. 861. Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.

No. 868. Cultural Methods and Tobacco Whitefly in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.

No. 890. Locusts: Instructions for dealing with Flying Swarms, by the Division of Entomology.

No. 892. The Tsetse Fly Problem in Southern Rhodesia, by R. W. Jack, Chief Entomologist.

No. 893. Experiments with Tsetse Fly Traps against Glossina Morsitans in Southern Rhodesia, by R. W. Jack, Chief Entomologist.

No. 894. Mycological Notes. Seasonal Notes on Tobacco Diseases. 6. An Unusual Type of Frog Eye Spotting, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

No. 896. A List of Plant Diseases Occurring in Southern Rhodesia. Supplement 3. (New Records for period June, 1932, to May, 1933.) Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.

No. 899. The Black Maize Beetle (Heteronchus Licus Klug), by C. B. Symes.

No. 904. Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932-1933. Part I.: Control of Locusts, by R. W. Jack, Chief Entomologist. Part II.: Biological Notes on the Red Locust, *Nomadacris septemfasciata*, Serv., by M. C. Mossop, A.F.C., M.Sc., Entomologist.

No. 906. The Locust Invasion of Southern Rhodesia, 1932-33, by R. W. Jack, Chief Entomologist.

No. 911. Screw Worm: A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Forword by R. W. Jack, Chief Entomologist.

No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.

No. 915. Tsetse Fly and Game, by R. W. Jack, Chief Entomologist.

No. 917. The Life History of the Screw-worm Fly, by Alexander Cuthbertson, Entomologist.

No. 934. Mycological Notes. Seasonal Notes on Tobacco Diseases. 7. Spraying in Seed-beds and Lands, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

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No. 942. Mycological Notes.—Seasonal Notes on Tobacco Diseases.—8. The Mosaic Mystery. 9. Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

No. 950. The Control of Tsetse Fly in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

No. 951. Suspected "Streak" Disease of Maize. Notice to Growers. By J. C. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

No. 962. The Report of the Chief Entomologist for Year ending 31st December, 1934, by R. W. Jack, Chief Entomologist.

No. 969. The Objects and Value of Seed Treatment of Maize against Diplodia, by G. M. Wickens, Ph.D. (Lond.), D.I.C., Assistant Plant Pathologist.

POULTRY.

No. 721. Poultry Keeping in Rhodesia: Pedigree Breeding, by H. G. Wheeldon, Assistant Poultry Expert.

No. 738. Hints to Breeders—Rearing Young Stock, by A. Little, Poultry Expert.

No. 740. Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon, Poultry Expert.

No. 761. Housing and Feeding of Adult Stock, by H. G. Wheeldon, Poultry Expert.

No. 795. The Turkey, by G. H. Cooper, Assistant Poultry Officer.

No. 803. Geese, by G. H. Cooper, Assistant Poultry Officer.

No. 827. The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.

No. 865. Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Chief Poultry Officer.

No. 870. Trap Nests, by B. G. Gundry, A.I.Mech.E. (combined with No. 875).

No. 872. The Poultry Industry: Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.

No. 875. Another Trap Nest, by B. G. Gundry, A.I.Mech.E. (combined with No. 870).

No. 884. The Vitamins in Poultry Feeding, by G. H. Cooper, Poultry Officer, Matopo School of Agriculture and Experiment Station.

No. 918. The Moulting of Poultry: The Normal and Pullet Moult, by H. G. Wheeldon, Poultry Officer.

No. 933. Ducks on the Farm (Revised), by H. G. Wheeldon, Poultry Officer.

No. 939. The Use of Galvanised Iron in the Making of Some Appliances for Poultry Keeping, by G. H. Cooper, Assistant Poultry Officer. Matopo School of Agriculture and Experiment Station.

No. 940. A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station .

No. 947. Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.

No. 966. Egg Marketing Bill: Draft of a Bill having for its purpose the more orderly Marketing of Eggs.

No. 971. Feeds for Poultry and How to Use Them, by G. H. Cooper, Assistant Poultry Officer.

The following pamphlets can be obtained from the Poultry Expert upon application:—

Selecting Birds for Laying Tests, by A. Little, Poultry Expert.
Tuberculosis, by A. Little, Poultry Expert.
Prevention of Disease among Poultry, by A. Little, Poultry Expert.
Preparing Birds for Show, by A. Little, Poultry Expert.
The Fowl Tick (Argas persicus), by A. Little Poultry Expert.
Culling: A Seasonal Operation, by A. Little, Poultry Expert.
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Partial Moult: Broodiness: Selection of Layers of Large Eggs, by A. Little, Poultry Expert.
Exhibiting Eggs at Shows, by A. Little, Poultry Expert.
Condition of Birds on Show, by A. Little, Poultry Expert.
Green Food: The Result of not Supplying Sufficient to Poultry, by A. Little, Poultry Expert.
Good and Bad Hatching Eggs, by A. Little, Poultry Expert.
Grading Fowls, by A. Little, Poultry Expert.
Housing: Three Important Essentials, by A. Little, Poultry Expert.
Advice to Prospective Poultry Farmers, by A. Little, Poultry Expert.
Seasonal Hints—August, by A. Little, Poultry Expert.

Successful Chick Rearing, by H. G. Wheeldon, Assistant Poultry Expert.

Hints to Breeders, October, by A. Little, Poultry Expert.

Abnormalities in Eggs, by A. Little, Poultry Expert.

Hints to Breeders. Prepare for the Breeding Season, by A. Little.

Respiratory Diseases, by A. Little, Poultry Expert.

Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.

The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 542. Review of the Abnormal Rainfall Season 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E

No. 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc. (Eng.).

No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.

No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.

No. 948. The Weather, contributed by The Meteorological Office.

AGRICULTURAL BUILDINGS.

No. 554. Pisé-de-Terre, by P. B. Aird.

No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.

No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.

No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.

No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.

No. 863. Piggeries, by B. G. Gundry, A.I.Mech.E.

No. 889. The Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.

No. 902. Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E.

No. 908. A Charcoal Safe or Cooler, by B. G. Gundry, A.I.Mech.E., Irrigation Divisiion.

No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by B. G. Gundry, A.I.Mech.E.,

No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.,

No. 941. A New Type of Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.

MISCELLANEOUS.

No. 518. Locusts as Food for Stock, by Rupert W. Jack, F.E.S.

No. 686. The Land Bank, Its Functions and How it Operates, by S. Thornton.

No. 687. The Use of Explosives on the Farm, by P. H. Haviland, B.Sc. (Eng.).

No. 702. Book-Keeping on the Farm, by T. J. Needham, Acting Accountant, Agricultural and Veterinary Departments.

No. 707. Wood-Charcoal in Southern Rhodesia, by T. L. Wilkinson, B.Sc., Assistant Forest Officer.

No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

No. 849. The Preservation of Farm Beacons, by L. M. McBean, Acting Surveyor-General.

No. 852. Mixing of Fertilisers: A Guide to Methods of Calculation, by the Division of Chemistry.

No. 858. The Softening of Waters, by the Division of Chemistry.
How to Make Use of the Fencing Law.
Twelve Simple Rules for the Avoidance of Malaria and Blackwater.
Summary of the Game Laws of Southern Rhodesia.

No. 910. The Toxicity to Grazing of Grass Sprayed with a Solution of Sodium Arsenite, by A. D. Husband, F.I.C., and J. F. Duguid. M.A., B.Sc.

No. 930. Analyses of Rhodesian Foodstuffs, by The Division of Chemistry.

No. 931. Charcoal-Gas as Fuel for Farm Tractors, by W. F. Collins, Assoc.R.S.M., "Riverside," Marandellas.

No. 935. The Weeds and Poisonous Plants of Southern Rhodesia, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture. Part I.

No. 949. Report of the Branch of Chemistry for year ending 31st December, 1934, by A. D. Husband, F.I.C., Chief Chemist.

No. 953. A Scraper for Levelling Land, by D. E. A. Gutsche, Field Husbandry Officer, Kakamas.

No. 954. Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts, by J. K. Charley, F.R.E.S., and R. McChlery. B.A., B.Sc.

No. 958. A Cheap Levelling Device, by A. W. Laurie, Howick Vale, Concession.

No. 961. A Home-made Ridger. Contributed by Mr. Douglas Aylen, Somerset, Concession.

No. 975. Fertilizers, Farm Foods, Seeds and Pests Remedies Ordinance, 1914.

No. 979. The Prospects of Black Bass in the Inland Waters of Southern Rhodesia. Specially contributed.

FARMERS' WANTS.

Advertisements under this heading will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words. The charges for these advertisements must be prepaid, and advertisements will appear on this page each month.

FOR SALE.

FOR all classes of WHITE LEGHORN and AUSTRALORP stock write to E. E. C. Green, The Kloof Stud Poultry Farm (The home of the long-distance layer), P.O. Box 879, Bulawayo.

WANTED.

WATTLED Cranes, Crowned Cranes.—J. R. Sherer, c/o The Zoo, Johannesburg.

MISCELLANEOUS.

SEE advertising pages for new price of Iron-Salt Stock Lick made by Rhodesian Iron Oxide Co., Hunters Road.

THE RHODESIA

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Pasture Investigations.—Attention is drawn to the progress report on pasture investigations carried out on the Salisbury Experiment Station which appears elsewhere in this number. The particulars given should prove of interest to all farmers as they prove that the old standard set in many parts of the country, *i.e.*, ten acres to a beast, can be very easily improved upon. It was stated recently in these columns that a few of our native grasses appeared to be as good as any grass reported from anywhere in the world, and it is clearly indicated that a number show such excellent promise that they certainly deserve the most careful investigation. It is well known that grasses vary considerably even in the same district and that selections can be made which are better than the average.

Work of this nature, together with experiments on the most suitable type of management for different types of soils, should give very valuable results. Farmers can assist in this work by supplying the Agriculturist's Branch with full details of their own grass experiments, giving particulars of the type of soil, grass used, fertiliser treatment, grazing periods, hay production, and particulars of any difficulties encountered in securing really satisfactory results.

The "Farmers' Weekly."—With the production of its March 11th issue the much-appreciated *Farmers' Weekly* completed its twenty-fifth year of production, and we wish to record, on behalf of its numerous readers in Rhodesia, our congratulations to the Editor and Staff. During the last twenty-five years it has established itself on a plane which is the envy of agricultural periodicals throughout the Empire, and we wish it continued success in the future.

Empire Fruit Growers' Conference.—Empire fruit producers will meet at a Conference to be held between June 29th and July 6th in London this year to discuss how Home and Empire fresh fruits will be affected by the expiration in November, 1937, of the Ottawa Trade Agreements Act (1932). Organisations represented on the Conference Committee are sending invitations to delegates from overseas. Only producers or their representatives will be invited.

Ammonia as a Fertiliser.—Acting on the knowledge that ordinary household ammonia, sufficiently diluted, makes an excellent fertiliser for ferns, some Californian citrus growers have been experimenting with this material on their orchards, with very promising results. One grower owning an 80 acre grove of oranges, as a result of experimenting on a few trees, has extended the application of ammonia in this form to the whole of his orchard. The liquid is mixed with the irrigation water in such proportion as to make the application equal to 9 lbs. of ammonia to each tree spread over five irrigations.

Green manuring is also practised to supply organic material, and heavier crops, better fruit and more vigorous growth of the trees are said to be the regular result.

Charges for Analyses.—In September last an article on domestic water supplies was re-published in this *Journal*, and by an oversight it was stated that chemical analyses were made by this Department free of charge. Owing to the excessive costs entailed in making large numbers of analyses for farmers the Government decided early in 1932 on the scale of charges given below, which it is considered is very reasonable and must be enforced in all cases in future.

Partial analyses of soil samples from bona fiide farmers to determine suitability for crops, and/or to make manurial recommendations ...	Free		
Complete analysis of a soil sample, including report and recommendations	£4	4	0
Partial analysis of any unregistered fertiliser or feeding-stuff, for each constituent	0	15	0
Partial analysis of a registered fertiliser or feeding-stuff, taken according to provisions of Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance	1	1	0
Complete analysis of any unregistered fertiliser or feeding-stuff	3	3	0
Complete analysis of a registered fertiliser or feeding-stuff, taken according to provisions of Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance	4	4	0
Analysis of water for agricultural purposes	0	10	6
Limestone, estimation of lime content	0	10	6
Limestone, complete analysis	1	1	0
Milk, cream or butter, for each constituent	0	10	6
Milk, cream or butter, complete analysis	1	1	0
Cattle dips	0	10	6
Viscera of animals—arsenic	0	10	6

Viscera of animals—strychnine, cyanide, nitrates or copper	1	1	0
Viscera of animals—general examination for poisons, from	*3	3	0

(*Depending on time involved.)

Samples to be delivered free of cost to the Department and to be accompanied by remittances for analysis required. No modification or remission will be made in any of these fees, except with the authority of the Minister of Agriculture.

Maize Stocks.—A statement on the maize stock position as at February 29th, issued by the Maize Control Board, shows that the quantity of maize surrendered to the Board was 1,136,970 bags. Of this total 805,067 bags had been surrendered by European growers and 163,187 bags by native growers, the balance of 168,716 bags representing the carry-over from the previous year, including 37,711 bags sold but not delivered.

The statement of sales shows that 909,241 bags had been disposed of. Of this amount 180,795 bags had been sold for export overseas, made up of 92,450 bags shipped and 88,345 bags committed for shipment. The amount disposed of locally was 728,446 bags. The maize sold as per schedule at February 29th, including 113,120 bags sold but not delivered, was 649,281 bags. Farm maize retained on payment was 4,947 bags. Native-grown maize retained by trader-producers on payment was 43,611 bags, and native-grown maize retained by farmer-consumers on payment was 30,607 bags.

The uncommitted balance at February 29th, was 227,729 bags.

Composts.—Since the article on the manufacture of composts was published in this *Journal* a number of enquiries have been received which indicate that many farmers are keenly interested and that there are still a number of points upon which further information is desirable. The following reply, which was sent to a farmer a few days ago, will help in this direction:—

"In reply to your letter I am very glad to hear you are commencing to make compost. It may reassure you to know that whatever mistakes you make at first in the proportions of the materials, and added water, dung, lime, etc., you will always in the end obtain the same essential product. Your mistakes merely lengthen the process.

"Compost can quite well be made from wheat straw, but the process will last rather longer and much more dung and/or kraal manure, and possibly some ammonium sulphate, will be required to supply nitrogen.

"If you have sufficient spread a layer of two or three inches of dung and half rotted kraal manure every 6 to 9 inches depth of materials as you build up the heap. Dung from a covered shed will be much more satisfactory than that from an open kraal. Sheep manure is *more* useful than cattle dung, as it is richer in nitrogen.

"Some field soil is necessary to supply the nitrogen—fixing bacteria, and the colloids (clay portion), which help to form the film on the surface of the stems and leafy portion of the wastes, which assists the fungi to commence work. I can only say use as much as you can up to the amount stated. A cubic foot contains $6\frac{1}{4}$ gallons, so if you can use one petrol tin full per yard length of the heap it may suffice. If you use much less it will merely lengthen the commencement of rotting.

"Air-slaked or water-slaked lime will do perfectly instead ground limestone.

"Since you are making your compost in the dry season with artificial water supply, you should make it in pits 2 feet deep, 15 feet wide and any suitable length, but not less than 55 feet. The sides and ends slope at 45 degrees. If there is danger of seepage from the water furrow do not set pits too near the furrow owing to the danger of water-logging. Build the heap in the pit up to 6 inches above the ground level, and leave about 9 feet empty at one end to allow for turning. Pits are not essential, but are best for dry weather compost, as they prevent loss of moisture and so economise in water and frequently of turning.

"When the heap is being made each layer may be watered until well wetted but not water-logged. It is best then to

turn the heap completely, mixing the dung, lime, etc., thoroughly with the straw. Sunnhemp should then be sown (if it will grow) immediately on the surface, and this should be particularly useful when composting a material very poor in nitrogen, like straw. Allow the sunnhemp to grow for one month to six weeks and then turn again, and water whilst turning.

"If the materials are not really rotting well add ammonium sulphate, by sprinkling thinly whilst turning, about half a bag per 45 feet length of pit should be approximately right, I think, but cannot say definitely.

"I shall be interested to know how the compost progresses. Remember that sufficient moisture, but not too much, an ample air and nitrogen supply, are the three essentials.

"I may mention that if the heap gives off ammonia in rotting it is a sign that the proportion of nitrogen is too high and the supply of dung and/or ammonium sulphate can be reduced in the future."

Notice to Growers of Flue-cured Tobacco.—The attention of growers of flue-cured tobacco is directed to the fact that in terms of the "Tobacco Marketing Act, 1936," all producers of flue-cured tobacco are required to make immediate written application to the Secretary, Department of Agriculture and Lands, Salisbury, for registration in the register of growers.

Any grower who fails to apply for registration cannot be issued with a Sales Quota Certificate.

When submitting this application, each grower is requested to furnish the following details:—

(1) Name of grower.

(2) Name of farm on which he grows tobacco.

(3) Postal address.

(4) Rhodesia Tobacco Association Area No.

A notice concerning the matter of registration of tobacco growers and the packing and marking of bales have already been published in the local press. A copy of this notice has also been posted to each individual grower whose name and address is known in the Department of Agriculture.

In the event of any grower having received no previous intimation it is now requested that application for registration be made immediately in order to avoid any further delay in the allotment of a registered number to such grower.

A circular letter addressed to those growers who did not apply to the Tobacco Quota Committee for a basic quota either during the 1934/35 or the 1935/36 season has been despatched to all such growers.

Any grower who has not received this circular is requested to forward immediately to the Secretary, Department of Agriculture and Lands, Salisbury, the necessary authority giving access to the grower's statistical returns lodged with the Government Statistician in order that such grower's basic quota and the sales quota may be duly allotted.

In the event of the statistical returns not being available it will be incumbent on the grower to submit a written statement showing the quantity of flue-cured tobacco produced by him during the seasons 1933/34 and 1934/35. Documentary proof of this production would also be required to enable a basic quota to be allotted.

Orderly Marketing of Potatoes.—It is with the object of endeavouring to impress upon growers of irrigated (winter grown) potatoes the necessity for the orderly marketing of their crops that this circular letter was issued.

Efforts have, in the past, been made by the Department of Agriculture to institute some voluntary means whereby the irrigated crop of potatoes, which is usually marketed from August to December, can be handled on a more satisfactory basis than in the past and to the advantage of growers.

Under the Trade Agreement with the Union of South Africa the importation of potatoes grown in that territory is prohibited and such produce may only be imported for consumption or for seed purposes into Southern Rhodesia under permit issued by this Department.

In view of the remunerative prices normally obtainable for the irrigated crop of potatoes and the control of imports which can now be exercised by the Department under the Agreement, the Government is anxious that growers should

secure the fullest financial benefits from their crops subject to reasonable prices to consumers.

In the absence, however, of a competent organisation for the orderly marketing of this crop, the Government is faced at times with a difficult position in that it cannot reasonably refuse to grant permits to merchants and consumers to import stocks when local supplies are not known to be immediately available to meet the applicants' requirements.

We are glad to be able to advise that a meeting of potato producers was held in Salisbury on the 10th inst. with the view to forming an Association, having for its aim the better marketing of this produce. This meeting was attended by many of the large growers of irrigated potatoes in Mashonaland and at that meeting it was resolved that an Association be formed for this purpose.

Messrs. G. R. Syfret and A. Pearson were elected as the nucleus of a Committee, and it was suggested that representatives of potato growers in other areas, notably Fort Victoria and Gwaai River Settlement, should be added to this Committee at a meeting to be called later.

It was decided that the crops of any grower would be handled through the organisation of the Farmers' Co-operative Society, Ltd., Salisbury, and its accredited agents. The crops to include both those of members and non-members of that Society.

A further meeting of all growers of irrigated potatoes took place on Thursday, the 19th March, at the offices of the Farmers' Co-op. Ltd., Salisbury, to discuss certain urgent matters connected with the new organisation and to meet the Committee of the Summer Potato Pool, which has already been functioning for two years, to the satisfaction of its members.

The co-operation of all growers is earnestly recommended and you are invited to give your support to this Association of Irrigated Potato Growers by joining it, to ensure the orderly marketing of this commodity and to assist the Department in controlling imports.

Further details may be obtained from the Manager, Farmers' Co-operative Society, Ltd., Salisbury.

ARMY WORM.

Recent reports of heavy outbreaks of Army Worm, or "Mystery Worm," in the Transvaal, indicate the necessity for watchfulness against the appearance of this pest on the part of Southern Rhodesian farmers.

To date the pest has only been reported from the Gutu and Victoria districts, but it may appear much further afield, as it is not unusual for extensive outbreaks to occur both in this Colony and in the Union of South Africa during the same season.

This pest is thought to be migratory, the moths covering large distances, perhaps hundreds of miles, in flight from one locality to another.

Most Rhodesian maize growers are only too familiar with Army Worm. The caterpillars measure in length up to about one and a half inches. They are smooth and predominantly dark green or black in colour, with some yellow and pale green longitudinal stripes on the sides. Their favourite food is sweet grasses, cereals and young maize. Crops other than those belonging to the grass family seem rarely to be attacked.

A pamphlet (Department Bulletin No. 796) on the subject of Army Worm is obtainable from this Department.

An outbreak of Army Worm at the present time would not be so serious a matter to maize farmers as if it occurred earlier in the season, when the maize is young, but young cereals, teff grass, etc., are liable to suffer seriously.

Clean cultivation in maize lands is a precaution against development of the pest actually in the crops, as the moths are extremely liable to lay eggs on rapoko grass (*Eleusine indica*), but as far as is known do not lay on maize plants, except when the plants are very young or when very young suckers are present.

Methods which may be used to protect crops or to destroy Army Worm are as follows:—

1. **Poisoned Bait.**—Chopped green stuff dipped in arsenite of soda 1 lb., cheapest sugar 2 lbs., water 16 gallons (four paraffin tins) makes a useful poisoned bait. The arsenite and the sugar should be dissolved in the water and the green stuff then dipped and drained. The bait can be spread, if possible on bare ground, in front of an advancing "army" at the rate of about 100 lbs. per acre. Sixteen gallons should wet 200 lbs. of chopped green stuff.

2. **Locust Poison.**—The caterpillars are readily destroyed by spraying with locust poison as used against locusts, namely, 3 ozs. of arsenite of soda powder to one petrol tin (four gallons) of water. Spraying the grass in front of an advancing swarm is also useful. Cattle dip (1-400 strength) can be used in place of arsenite of soda, mixing 4 fluid ozs. to a petrol tin of water.

Caution.—Keep stock away from sprayed veld until a heavy shower of rain has fallen.

3. **Trenches** about 18 inches square in section, with a perpendicular or overhanging wall towards the crops to be protected, are useful. Green stuff is usually strewn at the bottom and sprayed occasionally with locust poison.

Failing such a trench, which is laborious to dig, several furrows ploughed across the front of the advancing "army" and strewn heavily with bait as above make a good protective barrier.

4. **Spraying Crops.**—This is usually considered too expensive in practice. Arsenate of lead at a strength of 1 lb. in 30 gallons of water can be used. The addition of a spreader adds to its efficiency. Needless to say, arsenite of soda cannot be applied to growing crops without serious injury.

5. **Mechanical Destruction.**—Labourers can be sent through an infested crop to disturb the caterpillars which then fall to the ground, where they can be trodden on or otherwise destroyed. It is probably best not to aim at 100 per cent. destruction, but to work quickly through the land killing the majority of the caterpillars and so reducing the damage.

Brush drags can be used on bare ground to some advantage in favourable circumstances, and, of course, beating with branches is a common practice.

Caution.—It must never be forgotten that arsenite of soda and other compounds of arsenic are extremely poisonous, and the greatest care must be observed to keep stock away from sprayed veld until it has been cleaned by rain, and to avoid the possibility of accidents which might endanger human life. Arsenite of soda powder spilled on the soil might be eaten by children, European or native, and will almost certainly be licked up with fatal results by any grazing animals which have access to it. Keep all poison supplies under lock and key, see that any bait is completely utilised or destroyed and use ordinary common sense in dealing with the poison. A solution of arsenite of soda is caustic to the skin and contact should be avoided as far as possible.

Dry Land Pasture Grass Investigations

BY THE AGRICULTURAL BRANCH.

PROGRESS REPORT.

By H. C. Arnold, Manager Agricultural Experiment Station.

Introduction by the Agriculturist.—The following progress report forms a brief summary of the investigations carried out by the Agricultural Branch over the past sixteen years with the main object of ascertaining the most suitable of the indigenous and exotic grasses for use in laying down pastures in this Colony.

It will be seen that, to date, none of the exotic grasses has proved itself as valuable as the native grasses under dry land conditions.

The high stock-carrying capacity of the best of these grasses under proper management as compared with natural pastures has been demonstrated

A solid basis has been established which opens a wide field of opportunity for the extremely important work of the economic botanist in the selecting and breeding of superior strains of the best grasses as has been done with such outstanding success in other countries, notably New Zealand.

There is little doubt, too, that the intensive nitrogenous fertilising of high quality pastures on good loam soil would yield results in this country comparable with those obtained in Great Britain and the Union of South Africa in recent years. The dairy farmers of this Colony might well turn their attention to the remarkable possibilities this system offers for the reduction of their costs of production without further delay.

Report.—Preliminary trials with pasture grasses were commenced by the Agricultural Branch some sixteen years ago when material was collected from all parts of Southern

Africa as well as from many countries overseas. Small plots of each kind were established and much information regarding their agricultural potentialities was obtained. The following list gives the names of the more important grasses which have been included in our trials:—

	Popular local name.
Acroceras macrum	
Anthepora pubescens	Wool grass.
Andropogon sericens	Australian Blue grass.
Andropogon gayanus var. squamulatus	Rhodesian Blue grass.
Amphilophis insculpta...	Pinhole grass.
Brachiaria brizantha	Broad-leaved False paspalum.
Brachiaria nigropedata	Spotted False paspalum.
Brachiaria dictyoneura...	Creeping False paspalum.
Bouteloua curtipendula	Side oat grass.
Cynodon dactylon	Bermuda couch.
Cynodon hirsutus	Hairy couch.
Cynodon plectostachyum	Star grass.
Cenchrus ciliaris...	Droogland grass.
Chloridion cameronii	Gilston grass.
Chloris gayana (3 strains)... ..	Rhodes grass. Hunyani grass. Kafue Rhodes.
Digitaria Pentzii...	Woolly finger grass.
Digitaria milanjiana	Melanji grass.
Digitaria setivalva	Gwebi grass.
Digitaria scalarum	
Echinochloa pyramidalis	Antelope grass.
Eustachys paspaloides	Red Rhodes grass.
Haemarthria fasciculata	Swamp couch grass.
Hyparrhenia rufa	Thatching grass.
Ischaemum brachyatherum ...	
Leersia hexandra	Rice grass.
Melinus minutiflora	Molasses grass.
Panicum maximum	(4 strains) Guinea grass. Buffel grasses.

	Popular local name.
Phalaris tuberosa	Perennial Canary grass.
Paspalum dilatatum	Common paspalum.
Paspalum urvillei	Upright paspalum.
Paspalum scrobiculatum	Native paspalum.
Paspalum notatum	
Pennisetum purureum	Napier grass.
Pennisetum merkeri	Merker's grass.
Pennisetum clandestinum... ...	Kikuyu grass.
Berkeropis unisetum	Natal grass.
Rottboelia exaltata...	Kokoma grass. Guinea Fowl grass.
Setaria megaphylla	Broad-leaved garden grass.
Setaria splendida...	Great Timothy.
Setaria phragmitoides	Reed Timothy.
Setaria sphacelata	Golden Timothy.
Setaria Lindenbergiana	Rhodes tussock grass.
Setaria plicatilis	Folded leaf tussock grass.
Setaria longiseta...	Anthill tussock grass.
Sorghum arundinaceum	Native or perennial Sudan grass.
Sorghum versicolor	Black Sudan grass.
Sorghum vulgare (Sudanese)...	Sudan grass.
Sporobolus pyramidalis	Catstail grass.
Themeda triandra	Rooi grass.
Rhynchelytrum roseum	Red top.
Rhyncheltyrum nyassanum ...	Red top.
Urochloa mosambicensis	Gonya grass.
Urochloa bolbodes	

During the period these grasses were under trial in small plots special attention was given to such characteristics as:—Type of growth; earliness or lateness of the commencement of production of leafy growth and seed culms; yields of fodder and seed; amenability to propagation; resistance to the effects of drought; persistency; aggressiveness; the effect of close cutting (simulating grazing) at frequent intervals and response to fertilisers applications.

In collaboration with the Chemical Branch analyses were made at various stages of growth of all the more promising species.

After a few years it became evident that under the conditions of soil and climate found at this station only species indigenous to Southern Africa were likely to remain thrifty. The exotics were unable to withstand the effects of drought and the competition of weeds for more than a short period of years. The lack of one or more essential requirements further reduced the number of the grasses which could be considered suitable for establishment as permanent pastures on a large scale.

The most promising species were then planted side by side in order that information regarding their individual ability to withstand competition with other vigorous grasses could be ascertained.

In the season 1929/30 further progress was made by the establishment of *Digitaria Pentzii* (woolly finger grass) and *Chloris gayana* (Hunyani grass) in separate small paddocks each two-thirds of an acre in extent, with a view to testing their stock carrying capacity and behaviour under more practical conditions. Subsequently similar paddocks of pure stands of *Digitaria milanjiana*, *Brachiaria dictyoneura* and Rhodes grass were laid down, and also mixed stands of (*a*) *Setaria phragmitoides* under planted with stoloniferous grasses, and (*b*) stoleniferous grasses only which comprised a mixture of *Digitaria Pentzii*, *D. milanjiana*, *D. scalarum*, *Chloris gayana* and *Bracharia dictyaneura*.

With the object of forming an estimate of the comparative productiveness of the various paddocks it has been the practise to allow a single ox to graze in each paddock for as many days as it was possible for the animal to find food therein. When climatic conditions are favourable to the growth of grass it has been found necessary to increase the number of oxen in order to prevent the pasturage from becoming too coarse, while at other times the ox has had to

be removed for a time to prevent excessive grazing and trampling with injury to the sward. In the 1935 season the outbreak of foot and mouth diseases necessitated the removal of all cattle to the quarantine area and thus caused the suspension of our grazing experiments for the time being. Upon the return of the cattle it was found necessary to put a larger number of cattle than normal into the paddocks which had become somewhat overgrown.

To facilitate comparison, the amount of grazing produced by the respective paddocks is shown in the tabulation below as "ox-grazing days" for one acre.

PASTURE GRASS TRIALS.

Yields of Pasturage in Ox-grazing days per acre.

Season.	Woolly Finger.	Hunyani grass.	Digitaria milanjiana.	Brachiaria dictyoneura.	Rhodes grass.	Setaria phragmitoides mixture.	Stoloniferous grass in mixed stand.
1930-31	250	295	—	—	—	—	—
1931-32	316	307	—	—	—	—	—
1932-33	192	198	207	204	220	319	—
1933-34	238	238	190	385	156	243	251
1934-35	319	216	156	230	175	319	354
Average grazing days	263	251	184	273	184	294	302

These results show that with the possible exception of *Digitaria milanjiana* and Rhodes grass, one acre of any of these grasses, or the mixture of grasses, would provide grazing for one average sized ox for from seven to nine months, according to the season.

It is thought that a mixture or two or more kinds of the best grasses may ultimately be found to form the most satisfactory sward, for it is well known that while certain grasses

thrive at a certain place, other kinds may be more thrifty under other conditions of soil or situation found within a short distance. By mixing the grasses at planting time the various species would adapt themselves to the conditions that suit them best, and a uniformly satisfactory pasturage would be obtained. Before suitable mixtures can be determined, however, much experimental work needs to be done, for there is a danger that vigorous, short-lived grasses may be mixed with less aggressive but more persistent and valuable kinds, and that the object might be defeated in this way. The only mixtures which can be recommended are such as would include one or two upright but tufted grasses with a low growing, creeping grass such as the woolly finger to form a protecting covering for the soil between the tufts of the other grasses.

The returns shown for Rhodes grass would probably have been somewhat higher in the season 1933/34 but for its having been allowed to produce a seed crop before being grazed.

Although these experiments are as yet incomplete, and it is not possible to say that one grass is definitely superior to the others, there is little doubt that the woolly finger variety, with the possible exception of *Brachiaria dictyoneura*, appears to be more persistent than the others.

In addition to the grasses cited, large plots of a strain of *Panicum maximum*, known as Purple-top Buffel; *Urochloa mosambicensis* and *Urochloa bolbodes* have been established, but as they have been allowed to produce a seed crop before being grazed by the cattle their grazing returns are not comparable with those given above. Reports from farmers who have received seed of the Purple-top Buffel indicate that it may prove to be one of the most valuable of the species which can be economically established from seeds.

The fertility of the land on which these grasses were established had become much depleted by previous cultivation over a period of several years, and a dressing of 200 lbs. per

acre of superphosphate was disced in before the grass roots were planted. On the woolly finger grass and Hunyani grass plots further dressings of 200 lbs. per acre of superphosphate were broadcasted on the surface in the years 1931 and 1932 and all the various plots were top-dressed with 100 lbs. per acre of superphosphate in the year 1934. Commencing the second year after establishment, 150 lbs. per acre of sulphate of ammonia per annum has been applied to all these plots.

Recent experimental work, conducted at other centres, has shown that when the natural veld is top-dressed with phosphatic fertiliser, some four or more years may elapse before the grasses derive appreciable benefit from the treatment. In view of this, it is possible that almost as much fodder would have been produced if the surface applications of phosphatic fertiliser had been omitted from these plots, and some allowance should be made for this when the cost of the fertiliser is reckoned against the value of the grazing produced. Further, it seems it may be found that more economical results can be obtained by incorporating the whole of the phosphatic fertiliser dressing with the soil when it is being prepared for planting instead of frequent top-dressing of the pasture with smaller quantities of phosphate during the years following its establishment.

Report on The Curing of Rhodesian Hides.

By Advisory Committee on Hides and Skins of the Imperial Institute.

(NOTE.—The introduction to this summary and the description of the procedure at Bulawayo have been prepared by the Division of Animal Husbandry, the remainder of the summary is abstracted from the original report by the Advisory Committee on Skins and Hides of the Imperial Institute.)

INTRODUCTION.

The Summary of a very valuable report from the Imperial Institute is published below for general information.

It is generally known that all is not well with the Rhodesian hide trade and that the bulk of the hides sold in this Colony have a bad reputation overseas.

Before embarking on a campaign of improvement it was decided to have a number of hides cured in various ways and sent to the Imperial Institute for a complete report on the tanning qualities of the hides as treated. The experiment was carried out by the Animal Husbandry Division in co-operation with the Rhodesia Export and Cold Storage Company, whose help is gratefully acknowledged.

The hides were cured in six different ways as described in the report. From a farmer's standpoint the important methods are:—

(1) Sun cured by the method recommended by the Imperial Institute.

(2) Shade cured.

(3) Sun cured over poles.

(4) Sun cured on the ground in the usual haphazard way followed by many European farmers and most natives.

The report emphasises the enormous improvement in the quality and value of the hides which can be affected by little care.

A practical article on the preparation and curing of hides and skins and embodying the results of the experiment, will be published in the next issue.

The question of the actual sale of the hides has not been dealt with in this article. It may be stated, however, that at least one firm in this Colony has paid up to 5d. per lb. for the ordinary run of hides properly sun or shade cured. Good native hides have been purchased at 4d. per lb., or 5s. to 6s. per hide. The Department intends to prepare an exhibit of the kinds of leather made from these experiments as well as a number of pieces of leather showing horn, brand, tick and other damage at the next Bulawayo and Salisbury Shows. This exhibit should be of considerable interest to farmers.

The cracks reported in the sun-dried hides over poles are considered by this Division to be due largely to the fact that the hides were dried over ordinary 3 by 4 inch deals and the sharp corners of these latter caused the cracks. It is not thought that the same trouble would be caused if the hides were dried over smooth poles of 3 inches to 4 inches diameter.

SUMMARY OF REPORT.

The experiments were modelled to a certain extent on the scheme of investigation drawn up by the Committee and carried out by the Government of Kenya in 1932, the results of which were published in the Imperial Institute Report, "The Drying of East African Hides." The modified method of sun-drying hides which the Committee recommended as a result of that investigation, for employment where shade-drying is impracticable, was included in the programme.

The hides were cured by six different methods (Groups 1 to 6), carried out in dry weather (Lots A) and repeated in a

showery period (Lots B). For each of the twelve experiments 6 to 15 hides were employed, amounting to a total of 121 hides.

DETAILS OF EXPERIMENTS.

The hides, after being washed free from blood and dirt in all cases, were cured by six different methods, as follows:—

Group 1. *Pitted*.—The hides were placed in a pile flesh side up in a pit, salt being sprinkled freely on the flesh side. The hides remained in their own liquor for about 20 days, after which they were stacked to drain, re-stacked once or twice, and then bundled.

Group 2. *Dry-salted*.—The hides were salted very evenly, stacked for five days, and then dried over poles, flesh side up, in an iron shed with open sides.

Group 3. *Shade-dried*.—The green hides without salt were hung over poles, flesh sides up, in a shed until dry.

Group 4. *Sun-dried on Ground*.—The green hides without salt were opened (not stretched) on the ground, flesh sides up, until dry. The idea was to have a group cured in the ordinary native way.

Group 5. *Sun-drying method recommended by the Imperial Institute*.—Full particulars of this method are given in the Imperial Institute Report "The Drying of East African Hides."

In this method the hides are suspended from horizontal poles which are in a line running east and west, and at a suitable distance from the ground.

The tail butt and hind shanks of the hide are tied to the pole with ropes, while the head and fore shanks of the hide are tied to pegs in the ground, the hide being free of the ground. The pegs are placed on the line of the shadow thrown by the horizontal poles at midday. The hide is thus stretched at an angle with the ground, flesh side uppermost. At intervals, of perhaps a week or so, the line of pegs is adjusted to correspond with the shadow of the pole, which will have altered owing to the sun's position. The daily variation will not be large enough to be worth consideration.

By this method the hide is freely exposed on both sides for drying, a factor of prime importance; any rain which falls on the hide runs off, and the hide is exposed to the sun in such a manner that the rays fall very obliquely on it. The sun's effect is therefore less than when the rays beat directly on a hide stretched out flat on the ground.

The method does not necessitate so much equipment as is required for shade-drying, and is suitable for general application in both dry and wet seasons.

Group 6. *Sun-dried on Poles.*—The green hides, without salt, were hung, flesh sides up, over poles in the sun. Daily at noon they were turned so that the flesh and hair sides were exposed to the sun for the same length of time.

In Groups 2, 3 and 6 the hides were put over the poles along the backs from neck to tail.

Lots A and B.—Each Group of hides consisted of two lots—A and B.

Lots A, Dry Weather, were cured during a period of hot, sunny weather, and *Lots B, Showery Weather*, during a period of rainy, cloudy weather.

No great differences were anticipated between Lots A and B in Groups 1, 2 and 3, as they were all cured under cover.

Lots B in Groups 4, 5 and 6 were all exposed to rainy, cloudy weather and were soaked with rain several times before they were sufficiently dry to be taken into the shed. It was not anticipated that they would be of the same quality as the Lots A hides (in Groups 4, 5 and 6) which were cured in beautifully sunny weather.

While Groups 1 and 2 represent the methods followed by large firms, Groups 3, 5 and 6 represent methods which could be generally adopted by farmers and by natives in the Colony in preference to the method of Group 4, which is at present commonly used.

Fig. 1.—"Imperial Institute method" of drying. Group 5.

Fig 2.—Hides stretched on the ground to cure in the ordinary way. Group 4.

DETAILS OF HIDES AND CURING TIMES.

A—Cured in dry weather.

B—Cured in showery weather.

Group 1. *Pitted.*

A

No. of Hides.	Green weight. 8.11.34	Cured weight. 29.11.34	Bundled weight 14.12.34
14	915	789	834
Average	65.4	56.4	59.6

Hides cured and taken out of pit on 29.11.34.

Forwarded in wet, salted condition.

B

No. of Hides.	Green weight. 22.11.34	Cured weight. 12.12.34	Bundled weight. 14.12.34
6	422	361	378
Average	70.3	60.2	63

Hides cured and taken out of pit on 12.12.34.

Forwarded in wet, salted condition.

Group 2 *Dry-Salted.*

A

No. of Hides.	Green weight. 8.11.34	Cured weight. 29.11.34	Bundled weight. 14.12.34
14	917	477	493
Average	65.3	34.1	35.2

Salted and stacked 8/11 to 13/11 and then put over poles. These hides, owing to the large amount of salt on them, took long to dry and were only considered "dry" on 22.11.34.

Drying time, 9 days.

B

No. of Hides.	Green weight. 22.11.34	Cured weight. 12.12.34	Bundled weight. 14.12.34
6	426	213	222
Average	71	35.5	37

Salted and stacked 22/11 to 27/11 and then put over poles. With every shower of rain the salt on the hides absorbed moisture and the hides were only considered "dry" on 11.12.34.

Drying time, 14 days.

Group 3. *Shade-Dried.*

A

No. of Hides.	Green weight. 8.11.34	Cured weight. 29.11.34	Bundled weight. 14.12.34
14	914	407	382
Average	65.3	29.1	28

Considered "dry" on 16.11.34.

Drying time, 8 days.

B

No. of Hides.	Green weight. 22.11.34	Cured weight. 12.12.34	Bundled weight. 14.12.34
6	414	176	168
Average	69	29.3	28

Considered "dry" on 3.12.34.

Drying time, 11 days.

Group 4. Sun-Dried on Ground.

A				B			
No. of Hides.	Green weight. 8.11.34	Cured weight. 29.11.34	Bundled weight. 14.12.34	No. of Hides.	Green weight. 22.11.34	Cured weight. 12.12.34	Bundled weight. 14.12.34
14	901	356	370	6	450	170	179
Average	64.4	25.4	26.4	Average	70	28.3	29.8

A: Considered "dry" on 13.11.34. *Drying time*, 5 days.

B: Considered "dry" on 3.12.34. Had several showers of rain on them. *Drying time*, 11 days.

Group 5. Sun-Drying Method Recommended by Imperial Institute.

A				B			
No. of Hides.	Green weight. 8.11.34	Cured weight. 29.11.34	Bundled weight. 14.12.34	No. of Hides.	Green weight. 22.11.34	Cured weight. 12.12.34	Bundled weight 14.12.34
14	924	333	387	6	453	162	180
Average	66	23.8	27.6	Average	75.5	27	30

A: Considered "dry" on 13.11.34. *Drying time*, 5 days.

B: Considered "dry" on 1.12.34. Had several showers of rain on them. *Drying time*, 9 days.

Group 6. Sun-Dried Over Poles.

A				B			
No. of Hides.	Green weight. 8.11.34	Cured weight. 29.11.34	Bundled weight. 14.12.34	No. of Hides.	Green weight. 22.11.34	Cured weight. 12.12.34	Bundled weight. 14.12.34
15	989	380	411	6	412	159	168
Average	65.9	25.3	27.4	Average	68.7	26.5	28

A: Considered "dry" on 13.11.34. *Drying time*, 5 days.

B: Considered "dry" on 3.12.34. Had several showers of rain on them. *Drying time*, 11 days.

EXAMINATION OF THE CURED HIDES.

The investigation of the cured hides was undertaken by the Imperial Institute at the request of the Government of Southern Rhodesia, a report on the respective quality and value of the different groups of hides being desired.

The hides on arrival at the Institute were inspected by members of the Advisory Committee on Hides and Skins. Reports on the raw hides are given by the Chairman, Dr. Jordan Lloyd, and the Secretary, Dr. J. R. Furlong; by Mr.

H. W. Chadwick, of Messrs. Chadwick and Hollenbone: and by The Penketh Tanning Co.

TANNING TRIALS.

The hides were transferred to the Penketh Tanning Co. and put in work. They were given a vegetable tannage and finished as sole leather.

The finished leather was examined by the Chairman and Mr. R. Withinshaw (Penketh Tanning Co.). A microscopical examination of the corium of the leather from each experiment was made by the British Leather Manufacturers' Research Association.

CONCLUSIONS.

The reports furnished on the hides at various stages from raw hide to finished leather was considered by the Committee, the reports on the limed pelts and on the finished leather being of most importance in deciding the merits of the curing methods. In this connection it will be observed that damage not detected by an inspection of the raw hides was disclosed on working the hides in the tannery, particularly in respect of Group 4.

Group 1. *Pitting.*—The majority of hides in the group showed tender grain, with the result that when finishing the leather small patches of weak grain were rubbed off in the process. This method of curing hides with salt in pits must therefore be considered as unsatisfactory.

Group 2. *Dry-salting.*—The leather produced from the hides cured by this method was generally of excellent quality.

Group 3. *Shade-drying.*—The leather resulting from this method of curing was excellent.

Group 4. *Sun-drying on the Ground.*—The hides cured by this method were badly blistered and in the tanning trials yielded very poor results.

Group 5. Sun-drying by Suspension as recommended by the Imperial Institute.—The leather from hides of this group was of excellent quality.

Group 6. Sun-drying over Poles.—Although the hides cured by this method yielded leather of good quality in general, 50 per cent. of the hides gave leather showing damaged grain and cracked leather along the line of the back where the hide had been in contact with the pole. This method is therefore less satisfactory than the methods employed in Groups 2, 3 and 5.

There was no appreciable difference in value between the leather produced from the two lots A and B in each group of hides (*i.e.*, hides cured in dry and in showery weather respectively). It must be concluded that the contrast in the weather conditions was not sufficiently marked to have an influence on the results.

From this investigation the curing methods which have yielded the best results, and which can be recommended, are:—

Group 2.—Dry-salting.

Group 3.—Shade-drying.

Group 5. Sun-drying by suspension as recommended by the Imperial Institute.

Of these three methods that of Group 5 is the simplest. It has the advantage over the dry-salting method of Group 2 that no salt is required, and an advantage over the shade-drying process of Group 3 as no covering in the form of a roof is employed. Moreover, it can be carried out by the small farmer or native dealing with only a few hides at a time. There was no material difference in the quality of the leather from the three groups. It may be mentioned here that there is a stronger world demand for dried hides than for salted ones.

The sun-drying method on the ground by which the hides of Group 4 were prepared is condemned as highly unsatistory.

Pitting (Group 1) and Sun-drying over poles (Group 6) cannot be recommended on the results of these experiments.

In arriving at the above conclusions defects which had nothing to do with the method of curing were disregarded. In view of these defects (worm damage, branding, flaying cuts, damaged grain due to horn raking and thorn scratches) occurring to varying degrees in the different groups, it would be unfair to state the money value of the hides in each group, and regard such prices as an index of the merits of the various methods of curing. The value of the respective methods may, however, be stated as follows:—

The hides prepared by shade-drying (Group 3, A and B) and by sun-drying by suspension (Group 5, A and B) were excellent and would realise the highest prices. Hides of Group 2, A and B were also excellent, but being dry-salted would realise a lower price, proportionate to the lower yield of leather given by salted hides.

Hides of Group 6, A and B (sun-dried over poles) would realise ½d. per lb. less than those of Groups 3 and 5 owing to crackiness along the backbone line. Fifty per cent. of the hides showed this defect, which if present to a greater extent would still further reduce the value. Although the hides in Group 2, dry-salted, and in Group 3, shade-dried, were also dried over poles, no ill effects of the poles were noticeable in the finished leather from these groups. This may possibly be accounted for by the slower drying of these hides under cover.

The sun-dried hides of Group 4, A and B, were very poor and would realise 3d. per lb. less than the hides of the better groups, thus falling far below all the other groups in value. A comparison in price terms of the pitted hides cannot be made owing to the cure being a wet one.

In conclusion, it may be stated that the examination of the leather has shown the hides used in these experiments to be of excellent quality as regard leather-forming properties. The defects present, and to which attention has been drawn, are those due to preparation and handling. The hides when properly taken off and treated should be of high class quality.

Annual Report of The Branch of Chemistry

FOR YEAR ENDING 31st DECEMBER, 1935.

By A. D. Husband, F.I.C., Chief Chemist.

General.—The accomplishment of the routine analytical work that the Branch is called upon to carry out has occupied practically the whole time of the existing staff during the past year. The arrangement that has been made whereby all the standard iodine required by Cattle Inspectors attached to the Veterinary Department has now to be prepared in these laboratories has resulted in an increase in the ordinary routine work of the Branch.

In addition, owing to the serious illness of the Government Analyst, it was agreed that the more important of his duties should be carried out in these laboratories during the five months he was absent on sick leave. As for six months of the year one of the staff was absent on vacation leave, much of the research work previously in hand has had to be left in abeyance, in order that the ordinary routine work of the Branch could be satisfactorily accomplished.

In addition to analytical and advisory work in connection with agricultural problems, considerable assistance in connection with chemical problems has been rendered to other Government Departments, public bodies, and private individuals.

The ordinary routine work of the Branch consists of the following:—

1. Analyses of soils, manures, agricultural limes, waters for agricultural purposes, and general agricultural products.
2. Analyses of samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance."

3. Cattle dips and toxicological analyses for the Veterinary Department.
4. Analyses of samples and standardisation of glassware under the "Dairy Produce Act, 1925" and the "Dairy Industry Control Act, 1931."
5. Cleaning and treatment of tobacco seeds.
6. Preparation of standard iodine and sodium hydrate solutions for control purposes.
7. Advisory work by correspondence and interview.

Summary of Routine Samples.—The following comprises the samples analysed, examined, or otherwise handled, during the year:—

Soils	266
Manures and Fertilisers ...	44
Farm Foods	51
Cattle Dipping Fluids ...	16
Toxicological...	95
Limes	7
Waters	43
Vegetable Products	189
Dairy Products	3
Tobacco Seed Samples... ...	108
Miscellaneous	36
Research	164
Forensic	35
	1,057

In addition to the above, 70 litres of accurately prepared deci-normal caustic soda solution were prepared and despatched to the Dairy Officer and to private farmers throughout the country for use in acidity tests in milk, cream, and whey. Further, 85 litres of deci-normal iodine solution were prepared and delivered to the Veterinary Department, for issue to Cattle Inspectors under its control, thereby greatly reducing the cost and ensuring a standard basis of dip-testing throughout all the Colony. In previous years, when iodine supplies were purchased locally by each Cattle Inspector, not only was the charge naturally much higher,

owing to smaller supplies having to be prepared, but there were inevitable differences in the strengths from various small suppliers.

Soils.—Nearly one hundred more soil samples were dealt with in 1935 than in the preceding year, 266, as against 168. Of these, 118 were examined and analysed for farmers with a view to determining their suitability for maize and general crops, and advice given accordingly, accompanied usually by fertiliser and general recommendations as to necessary treatment. One hundred and thirty-five were from tobacco or prospective tobacco or tobacco seed-bed soils, only two of these being of the fire-cured type, all others being for flue-cured leaf. The remaining 13 samples were received from the Beit Research Worker in Trypanosomiasis and were collected from certain areas infested with tsetse fly. It was sought to ascertain whether these presented any feature as regards mechanical or chemical composition which might account for their suitability or otherwise for the propagation and perpetuation of the "fly," and development of its puparia.

Results of analysis showed that the samples from fly-free areas were coarse sandy soils, with very low inherent fertility, exceptionally lacking in humus and hygroscopic moisture, and acid in reaction, the pH's ranging from 5.99 to 6.20. On the other hand, the samples from tsetse-infected areas were of much higher fertility, containing a considerably greater proportion of fine sand, silt, clay, and humus, in addition to more of the essential food elements. They were, as a general rule, more alkaline in reaction than the former set, their pH's ranging from 6.1 to 8.17.

It is suggested that these observations may help to explain the persistence of the fly in certain small, well-defined areas, when after the rinderpest epizootic in 1896, it disappeared from the rest of the country.

Manures and Fertilisers.—Of the 44 samples tabulated under this heading, 30 were taken and analysed under the terms of the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance," and all were found to conform to their registered compositions, within the limits allowed under the Regulations. Samples were taken at Salisbury, Umtali, Bulawayo, and Gwelo, at different times throughout the year.

Eight of the remaining 14 classified as manures were samples of a manurial material called Bacterised Peat, or "Bacpeat," received from a commercial firm in Salisbury. It was claimed for this substance that it was an ideal organic fertiliser and a medium for the active production of nitrogenous matter by bacterial action. An experiment was instituted to test out the effect of the bacpeat on ordinary soil and on two further samples of the same type of soil with which sulphate of ammonia and bloodmeal were incorporated respectively, the same amount of nitrogen having been added in each case. All samples were incubated for four weeks at a temperature of 35°C., and finally analysed. It was found, as the result of analysis, that there was no marked increase in nitrification due to the bacpeat, except in the sample of untreated soil, where the increase in nitric nitrogen was 230 per cent.

Practical experiments were also carried out with this substance on the small grass plots surrounding the laboratories, but with inconclusive results.

The final six under this heading call for no special comment, being mainly private owners' samples analysed for manurial value.

Farm Foods.—Six of the 51 samples enumerated here were taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance," and one of these was found to be markedly below its guarantee in protein content. This has been dealt with, and in respect of this same material or others from the same source, a similar deficiency is not likely to occur in future.

Nine samples of meat, blood and carcase meals were analysed for the Rhodesia Export and Cold Storage Company, Limited, who are attempting to improve still further the quality of their by-products in respect of protein content, at the expense of the fat.

The other 36 farm foods were mainly feeding cakes or meals, none of them being of more than ordinary interest.

Cattle Dipping Fluids.—Four of these were standard iodine solutions from Cattle Inspectors for checking purposes, 9

were samples of cattle dips sent in for analysis by farmers, cattle inspectors, or commercial firms, and the remaining 3 were concentrated dips received from the Tender Board for examination and recommendation as to the most suitable of them for Government purposes.

Toxicological Analyses.—The number of these (94) is comparable with that for previous years. Seventy-four were specimens of viscera of animals, stomach contents, soils, and grass for analysis for arsenic, and of these, 45 were found to be positive, while 29 either contained no arsenic or a negligible quantity of it. It would appear that there is no further danger to stock to be apprehended from the locust spraying operations of the past two years. The number of positive results (45) is considerably lower than the normal for previous years, for which accident and careless handling of dip are primarily responsible.

Five samples were analysed for the Chief Entomologist in connection with an experiment designed to ascertain the effect of feeding poultry on locust hoppers sprayed lightly and then heavily with arsenic of soda. The experiment showed that when arsenic is administered in small quantities, such as are contained in sprayed locusts, the bird can tolerate comparatively large doses without any visible ill effects.

Four other samples of locust powder were also examined for the Chief Entomologist, as regards solubility of contained arsenic, etc.

Ten analyses for arsenic were carried out for the Beit Research Worker, in connection with his trypanosomiasis experiments on sheep, to test the effect of different arsenical injections.

Two samples of renal calculi from animals in the Melsetter district were examined, and the concretions found largely to consist of xanthine stones.

Reference to the occurrence of these stones in cattle was made in my Annual Report for 1934, and it appears that every year, in the latter part of the dry season, a number of deaths occur among cattle on farms in the Melsetter district from this cause. As previously pointed out, the actual cause

of death is due to the obstruction of the urethral passage, which results in the rupture of the bladder. It is probable that the animals that die represent only a small proportion of those actually affected, as in many cases the stones pass out of the bladder before they are large enough completely to obstruct the urethral passage. No investigatory work has been carried out with the object of determining the cause of the occurrence of these stones in cattle, and, as the matter is of considerable scientific interest, as well as of practical importance to farmers in the Melsetter district, it is desirable that the problem should receive further attention, as it is always possible that the losses of animals from this cause may eventually assume greater significance than our records at the present time indicate.

Limes and Limestones.—These, 7 in number, were ordinary routine samples from various sources, for determination of lime and magnesia for agricultural purposes.

Waters.—Thirtytwo of the 43 specimens classified under this head were from streams in the Melsetter district, and were analysed with a view towards obtaining, if possible, some clues explanatory of the presence of xanthine stones among the renal calculi of animals in that locality. All samples were found to be abnormally low in soluble solids content, being practically pure waters.

Five samples were for boiler feed purposes, and the others for irrigation use.

Vegetable Products.—Thirty-nine of the 189 items classified under this title were samples of tobacco leaf received from the newly-founded Tobacco Research Station, Trelawney, for determination of the percentage of nicotine.

Twenty-two samples of silage were analysed for protein content, before and after ensiling. These were done by arrangement with the Chief Animal Husbandry Officer, and supplies came from different farms throughout the country. The object was to discover whether the addition of molasses to the raw material had any effect on increasing the protein content of the finished silage. Result were inconclusive and disappointing, slight increases in a few, no effect at all in others being evidenced.

Sixteen analyses of grasses were completed, 12 of these being for the Government Farm, Matopos, and the moisture and protein contents of 76 varieties of wheat were ascertained for the Plant Breeder.

Three samples of different varieties of geranium plants from the Salisbury Experiment Station were analysed for their essential oil content. Unfortunately this was found to be very low, and, further, the majority of the small amounts of oil extracted bore the odour of lemon, instead of having the desired rose flavour. Further trials are being made in 1936.

The remaining 33 samples were miscellaneous ones, such as varieties of wood from the Forest Officer for densities and calorific values, forage, green oats, potatoes, maize for moisture, stink-blaar seeds, etc.

Dairy Products.—These were 3 in number, all being samples of milk which were tested for normality or otherwise.

Tobacco Seed Samples.—The number of these samples treated during 1935 is slightly less than that for the previous year, but the total weight of seed handled is approximately the same, 236 lbs. in all passing through. A new and very efficient electrical apparatus for cleaning the seed has been installed, thereby greatly reducing the amount of work which was involved in the laborious process of foot-blowing employed in previous years. Even then, for more than one month, almost the whole time of one of the junior officers was employed on this work.

Miscellaneous.—Included in the 36 entries here are 23 samples of iron oxide submitted from various sources in order that their percentage of iron, of arsenic, and their general suitability for feeding as a mineral supplement to cattle, might be ascertained. Some of these samples were of very high quality, showing up to 90 per cent. of Fe_2O_3 and complete freedom from arsenic.

The remainder included soaps, sugar canes, locust juice, white ant preventative, chewing tobacco, paints, etc. None calls for special mention.

Forensic.—Owing to the serious illness of the Government Analyst and his absence from duty on sick leave, the more important part of his duties was undertaken by this Branch from 6th May to 30th September, inclusive. In all 35 cases were dealt with. Of these 23 were in connection with murder or suspected murder investigations, involving in all 54 exhibits, of which 21 were samples of human viscera, and the remaining 33 miscellaneous articles, such as foodstuffs, powders, tablets, and various native concoctions and medicines. The other 12 comprised 7 exhibits of animal viscera, 1 food, 1 hair, and 3 waters.

RESEARCH.

A. **Nitrification Experiments.**—In the Annual Report of this Branch for the year 1934 a condensed summary was given of an experiment instituted to test the nitrifying capacity of soil from the Salisbury Experiment Station on bloodmeal and sulphate of ammonia under incubation conditions. It was mentioned that over three different periods of one month each, nearly twice as much bloodmeal as sulphate of ammonia had been nitrified, and that the experiment was under way again with the soils exposed to natural conditions.

Twenty-one of the samples classified under the heading of Research were analysed in connection with this work. Soil containing a definite proportion of bloodmeal in one case, and of sulphate of ammonia in the other, was placed in a condition as closely as possible resembling its natural state in an apparatus designed to simulate a miniature lysimeter.

Soils and drainage waters were removed at the end of one month, two months, and three months, respectively, and their contents analysed for nitric nitrogen.

The results obtained from the soil-drainage water of one month's exposure were strictly comparable to those previously found under incubation conditions. Nineteen per cent. of the added bloodmeal had been nitrified as against 11 per cent. of the sulphate of ammonia. At the end of two months 51 per cent. of bloodmeal and 31 per cent. of sulphate of ammonia were nitrified. At the end of three months, however, the final results were 54.5 per cent. for bloodmeal and 62.5 per cent. for sulphate of ammonia.

All these results seem to indicate fairly conclusively that under conditions pertaining here in the early part of the growing season bloodmeal is much more quickly nitrified than sulphate of ammonia, but that in the end more nitric nitrogen is obtained from the sulphate of ammonia. This experiment is again under way with slight improvements in the technique, with more replications, and with a set of soils which will be left over for four months in all. It is also intended to estimate the ammoniacal nitrogen as well as the nitric nitrogen, and cognisance will be taken of the soil temperatures.

B. **Green-manuring: Sunnhemp** (58 Samples).—The experiment commenced last year to ascertain the optimum time for ploughing in a green crop of sunnhemp was continued this year in a modified form. Ten small plots in a maize rotation were taken, and, commencing when the crop was two months old and just coming into flower, one plot was ploughed under at weekly intervals and samples taken for analysis. The carbon and nitrogen contents of the 10 samples were determined. In addition, soil samples were taken from three of these plots and from a near-by piece of bare land to serve as control. Soil samples were taken at intervals throughout the dry season and the decomposing crop examined from time to time. In all 48 of these samples were analysed for total nitrogen and nitric nitrogen.

From a theoretical consideration of the results of analysis of the sunnhemp, the correct time to plough under the crop would be twelve or thirteen weeks after planting. From the appearance of the crop and without knowledge of the results of analysis, the optimum time was considered to be when the crop was twelve weeks old.

The soil analyses show that the growing crop had utilised all the nitrate in the soil, and after ploughing under the sunnhemp, nitrification proceeded slowly for a few weeks, then rose more rapidly. On the plots ploughed in early there appeared a loss of nitrate during the dry season, whereas on that ploughed under at optimum time the nitrate content was maintained. Little decomposition and nitrification took place on the plots ploughed in when the crop was coarse and fibrous.

It is intended to examine these results further in the light of the yields of maize obtained from the plots in 1936.

Tobacco.—During the latter part of 1934 some experiments were carried out in collaboration with the Lytton Tobacco Export Company on the flavouring of tobacco, with the object of finding a treatment which would render our tobacco more suitable to the West African market. A small trial shipment of variously treated tobaccos was sent to West Africa; this tobacco was favourably reported upon by the buyers, but, unfortunately, it was not stated which of the treatments was the most satisfactory. These experiments have been repeated during the year under review and samples were sent to Mr. Berrett in London and a shipment of about 1,500 lbs. to West Africa. It is hoped that a full report upon these tobaccos will be forthcoming, as this would assist the planning of any further experimental work in this connection that may be necessary.

RESEARCH INTO THE IMPROVEMENT OF NATURAL PASTURES.

Pasture Research Station, Matopos.

Blackland.—The successive droughts experienced during the past three years on this Station have seriously affected both the hay and grazing paddocks situated on the heavy black soils. Owing to the shrinkage of the clay, huge cracks several feet deep were common right through the paddocks and the exposure of the grass roots in these cracks resulted in many plants dying out. Although under favourable conditions good yields of excellent quality hay are obtainable on these blackland paddocks, it appears that such favourable seasons are getting fewer and further between in this area of the country.

During the season under review the rainfall was 21.6 inches on 42 rain days. The rains commenced at the beginning of November and continued fairly evenly until 10th February. From 10th February until 18th December only 0.9 inches of rain were recorded on the Station.

Although, therefore, the rainfall in the early part of the season was satisfactory, this was followed by a drought period

of over ten months, which completely erased the recovery that was taking place in the grassland from the favourable rains at the commencement of the season.

Had the previous drought years not exercised so severe an effect on the hay paddocks, a good hay crop might have been expected during the 1935 season, but, although the yields obtained were over 100 per cent. greater than the average of the preceding three years, they were still only approximately 50 per cent. of the average obtained during the good seasons of 1930 and 1931. It is true that no fertiliser has been applied to any of these paddocks for the past three years, but it will be seen from the following table that the differences in the percentage yields from the unfertilised paddocks are of the same order as those from the fertilised paddocks.

Yields per acre of lbs. from Blackland Hay Paddocks.

Treament.	Average 1930 & 1931	Average 1932, 1933, 1934.	Yield 1935.	Average over six years.
N.P.K. ...	2,022	439	1,015	1,063
P.K.	1,585	444	1,004	918
Super	1,627	407	1,067	924
Raw Rock. .	1,560	435	751	863
Control ...	1,647	470	832	923

Sandveld.—Reference to the fact that the sandveld section at Matopos appeared to be much less adversely affected by drought conditions than the blackland has been made in my Annual Report for the past two years.

This is again evidenced in the yields of hay obtained during the season 1935, and a study of the hay yields from the two sections on the Station will show that, whereas in 1931 the hay yields on the blackland section were over 100 per cent. greater than those on the sandveld, in the year 1935 the hay yields from every paddock on the sandveld are slightly higher than the yields from the corresponding paddocks in the blackland section.

Considering the unfavourable seasons that have been experienced on the Station for the past three years, it is remarkable how greatly the sandveld section has improved, and the results demonstrate clearly the value of veld control on soil of this nature.

As drought conditions in the Matopos area seem to be the rule rather than the exception, endeavour was made last season to cut the grass on every available piece of veld on and round about the Station, with the object of making provision for a possible long dry season.

The result of this procedure was that, despite the following ten months' drought, ample hay was available for all the stock right through the dry season and a surplus of approximately 30 tons of hay is being carried over for the next dry season. No animals died from poverty on the Station, and even the cows that calved in the last two months of the drought period were successfully brought through.

The value of the mowing machine on sandveld areas in Matabeleland cannot be over-estimated, as not only is it possible with this machine to take full advantage of all the available veld herbage, but also by its use the veld can be considerably improved and losses of cattle from poverty materially lessened.

Yields per acre in lbs. from Sandveld Paddocks.

Treatment.	Yield 1931.	Average 1932, 1933	Yield 1934.	Yield 1935.	Average for five years.
N.P.K.. . .	956	611	952	1,132	852
P.K.	608	307	941	1,160	665
Super . . .	624	352	793	1,079	640
Raw Rock .	—	288	951	955	621 for four years only.
Control . . .	483	248	797	913	538

Results of Analysis of Hay Samples.—Altogether 17 samples of hay were analysed from this Station; 8 being blackland hay and 9 sandveld hay.

Blackland.—Owing to the grass on these paddocks having suffered so severely from the three previous drought years, it was not cut until much later than usual. Therefore, as might be expected, the quality of the hay was not so good as in previous years.

There is still, however, a difference between the hay from the paddocks fertilised in previous years and that from the unfertilised control paddocks.

There was little difference between the hay from the various fertilised paddocks, with the exception that the paddocks previously fertilised with muriate of potash have given hay generally richer in potash and chlorine.

The following figures show the mean analyses of the hays from the treated and untreated plots.

	Protein. %	K_2O. %	P_2O_5 %
Mean values from paddocks previously fertilised ...	4.59	1.21	.27
Mean values from control paddocks	4.03	.96	.17

Sandveld.—As judged by the chemical analysis, the hays from this section of the Station were very comparable with those obtained on the heavier blackland paddock.

It will be seen from the following figures that, compared with 1934, the hay obtained in 1935 was of higher quality, although in both years the grass was cut out in the same month.

		Protein. %	K_2O. %	P_2O_5 %
1934	Fertilised (mean analysis)	4.0	1.33	.37
	Control	3.2	1.15	.34
1935	Fertilised (mean analysis)	4.7	1.58	.42
	Control	4.0	1.39	.24

There was very little difference between the hays from the various fertilised paddocks, all of which were appreciably better than that from the control.

As in the case of the blackland paddocks, the hay from the sandveld previously fertilised with muriate of potash had a considerable higher potash and chlorine content than the hay from the other paddocks.

Experimental Animals: Matopos.—Despite the drought conditions that have prevailed on this Station for the past four, years, all of the animals were successfully carried through the last long dry season.

This, however, as previously mentioned, was only made possible by the procedure which was adopted of cutting hay on all available land attached to the Station.

Thirty-four calves were born during the year, therefore the fertility of the cows still maintains a high level. Although no symptoms of nutritional anaemia similar to those at Marandellas are apparent among the cows on this Station, a number of the animals always fall away badly in condition towards the end of the dry season. In May last these animals were separated from the others and were given access to the salt, iron and copper lick, as is fed on the Marandellas Station. It was noted that these cows were in much better condition than usual at the end of the present dry season, although the new grass was at least two months later in making its appearance owing to the rains commencing much later than is normally the case. In the circumstances, it was decided to carry out more extensive experiments with the feeding of this lick to groups of cattle in the same manner as at Marandellas.

After a few weeks it was found that these animals took the lick quite readily, although the quantity consumed by them is only approximately half that eaten by the Marandellas animals. This experiment has not been long enough in progress for definite deductions as to its effectiveness to be made and the work is being continued. Observations made on the animals on this Station tend to indicate that all the animals grazing on the paddocks that were previously fertilised with muriate of potash make better growth than those grazing on the unfertilised paddocks or those which received only dressings of phosphatic fertilisers. This indicates that the increased potash and chlorine content of the grass on the paddocks that received muriate of potash is exercising a beneficial effect on the grazing animals.

Pasture Research Station, Marandellas.

Rainfall.—On this Station the rainfall for the season was 40.3 inches in 78 rain days. Rains set in on 13th November and from then until the end of February there were 32.4 inches in 59 rain days. There was practically no rain in March until after the 16th, and only three-quarters of an

inch in April. The continuous rain in the early part of the season, followed by the dry weather in March and April, exercised an adverse influence on the yields of hay which, as will be seen in the following table, were the lowest obtained during the past five years.

Yields per acre in lbs. from each Treatment.

Treatment.	1931.	1932.	1933.	1934.	1935.	Mean.
N.P.K. . .	1,183	1,631	1,521	1,225	948	1,302
P.K.	875	1,310	941	1,009	823	992
Super . . .	871	1,034	905	1,035	667	902
Raw Rock	627	960	682	844	658	794
Control . .	890	951	621	703	523	738

No fertiliser has been applied to any of the paddocks since 1933, but the residual effect of the fertiliser applied in the years 1931-1933 is still apparent in the yields obtained during the 1935 season.

It is of interest that the yields of hay from the P.K. and N.P.K. paddocks during the past unfavourable season were equivalent to those obtained on the unfertilised paddock during the 1932 season, which was an exceptionally favourable year for hay on this Station.

Results of Analyses of Hay Samples.—As in past years eighteen samples of hay from the various paddocks were taken for analysis, but, owing to pressure of other work, only nine of these samples have so far been analysed. The completed samples represented the hay from the early cut paddocks, and the results of analysis show that, compared with the hay cut in February, 1934, this year's samples have an appreciably higher feeding value. The reason for this is undoubtedly due to the unfavourable growing season, which considerably retarded the growth of the grass and, therefore, although it was cut in the same month as in preceding years, its feeding value could be expected to be greater, as its usual stage of maturity had not been reached.

An examination of the results obtained over the five years that the experiments have been in progress indicates that the influence of fertilisation is much more marked on the quantity than on the quality factor, although the hay from all the

fertilised paddocks is slightly superior in feeding value to that from the unfertilised paddocks. Very little difference exists between the quality of the hay obtained from the paddocks which received various fertiliser treatments, with the one exception of that from the paddocks which were previously treated with muriate of potash. During the past season all of the hay from these paddocks had a considerably greater chlorine content than the hay from the other paddocks which were treated only with phosphatic fertilisers. The last dressing of muriate of potash was applied in the season of 1933, and it is rather extraordinary that the chlorine content of the hay is higher two years after these applications were given than in the years in which they were applied. The figures in the following table show a comparison between the hay obtained from the fertilised and unfertilised paddocks during the years 1934 and 1935. The chlorine figures for fertilised hay refer only to those paddocks which received dressings of muriate of potash, as compared with the average chlorine content of all the other paddocks treated or untreated with fertilisers other than those containing chlorine.

	Protein. %	K_2O. %	P_2O_5. %	Cl. %
February, 1934—Fertilised ...	4.8	1.33	.37	.22
Control	4.4	1.33	.32	.19
February, 1935—Fertilised ...	5.8	1.81	.43	.27
Control	4.7	1.73	.40	.19

Experimental Animals: Marandellas.—In my Annual Report for 1934 full details were given regarding the experiments that were being carried out to determine the influence of feeding a salt lick composed of sodium chloride, oxide of iron, and copper sulphate on the condition of nutritional anaemia prevalent amongst the breeding cows on this Station.

This work has been continued and the results obtained give further proof of the value of this lick to animals grazing on sandveld of the Marandellas type.

Reference was made last year to the high cost of iron oxide being largely due to rail charges. Representations were made to the Beira & Mashonaland & Rhodesia Railways

and it is gratifying to be able to record that they agreed to make very substantial reductions in the railway rates on this material.

It is of even greater interest that a deposit of suitable iron oxide for feeding purposes has been located in the Hunters Road district and is now being worked by private enterprise. It is anticipated that this material will shortly be available at a much reduced price and that farmers will be able to purchase the lick, ready prepared, at a price very little in excess of that at present paid for ordinary salt.

As previously recorded, the feeding of this lick exercised a marked influence on the general condition of the breeding cows and increased their fertility, as well as favourably affecting their milk yields. The difficulties usually encountered in cows calving during the dry season have entirely disappeared in the groups receiving either salt alone or the salt, iron, and copper lick, whereas they still exist among the animals receiving no mineral supplements.

It is significant that the group of animals (P.K.) grazing on paddocks that were previously fertilised for three years in succession with 100 lbs. to the acre of muriate of potash, consume much less of the lick than the group which is running on unfertilised paddocks. The chemical analyses show that the hay from the fertilised paddock contains a considerably higher percentage of chlorine and more more potash than the hay from the unfertilised paddock.

As both groups of animals are allowed free access to the lick at all times, it would appear that the additional chlorine contained in the grass from the P.K. paddocks satisfies to a large extent the requirement of the grazing animal for this element.

It is also noticeable that, although very little difference can be seen between the cows in these two groups, the calves in the P.K. paddock definitely grow out better than those in the unfertilised paddock, although they all receive the salt lick *ad lib*.

The average weight at birth of 10 calves in the P.K. group was 57 lbs. and at nine months of age 348 lbs. In the

control group, grazing on the unfertilised paddocks, but receiving the salt lick, there are 9 calves, their average weight at birth being 63.6 lbs. and at nine months of age 310 lbs. As on both Stations the calves seem to grow better in the P.K. group, it appears possible that this may be due to the increased potash content of the fertilised grass, and it is hoped during the coming year to test out the effect of increasing the potash intake of the animals grazing on paddocks not fertilised with potash.

It is of interest that in the N.P.K. group, which receives no minerals, only four calves were born, their average weight at birth being 56.8 lbs. and at nine months of age 240 lbs.

An experiment was carried out during the past year to determine whether the addition of lime to the salt, iron, and copper lick would exercise any additional beneficial effect.

The group of animals (C group) which were the first animals on the Station to receive the salt, iron, and copper lick, were now fed the lick mixed with equal parts of dried slacked lime. These animals at first showed less inclination to consume the new lick, but after a few weeks took it quite readily. After six months on this new lick all the animals went back quite definitely in condition and it was therefore discontinued.

N.P.K. Group.—The animals in this group graze continuously on paddocks that were fertilised annually from 1931 to 1933 with a complete fertiliser containing superphosphate, muriate of potash, and sulphate of ammonia.

The grazing on these paddocks is the best on the Station, and, therefore, this group of animals was chosen for the controls when the mineral feeding experiments were commenced. The potash and chlorine content of the grass on these paddocks is very similar to that of the P.K. paddocks, and it was therefore anticipated that the onset of any symptoms of disease in the animals grazing on these paddocks would be more slowly evidenced than in animals grazing on the paddocks to which clorine in the form of muriate of potash had not been applied. During the past year exactly similar results were obtained to those reported for the previous year.

The cows in this group were apparently in very good condition prior to calving, but immediately after calving they fell away rapidly in condition, although there was ample grazing and the grass was at the stage of growth when it has its maximum food value.

To heifers in this group, N. and N.11, calved on 12th November, 1934, and 12th December, 1934, respectively. N.11, just prior to calving, weighed 768 lbs.; by the beginning of March her weight had dropped to 540 lbs., and she died on 27th March.

Mr. L. E. W. Bevan, M.R.C.V.S., who was present on the Station when the animal died, kindly consented to carry out a *post-mortem* examination to determine whether the death of the animal could be attributed to any cause other than that of nutritional anaemia suspected. He reported as follows:—

"On *post-mortem* examination no marked lesions could be found except those associated with intense anaemia. The carcase and the body tissue contained very little blood, but the haemoglobin index (Tallqvist scale) was as high as 60. The anaemia, therefore, was probably due to reduced quantity rather than deficient quality of the blood.

"The abomasum contained innumerable 'wire-worms' (*H. contortus*), and the large bowel some *Oesophagostomes*, which may have contributed to the general weakness and anaemia.

"Search was made for 'fluke' and other parasites, but without success."

Specimens of the long-bones were taken and these were kindly examined by Dr. W H. Blackie, Director of the Pasteur Institute, who reported as follows:—

"*Tibia.*—The narrow cavity was filled with a reddish jelly like mass from which a thin watery fluid (paler than normal serum) exuded. Small portions of marrow selected from different levels of the diaphyseal cavity *floated* when placed in tap water. There was no evidence of extension of the marrow into the epiphyseal end of the bone.

"*Femur.*—The lower end of the marrow cavity contained some red marrow which sank when placed in tap water. The greater part of the cavity was filled with a pinkish fatty marrow which floated in water. These findings suggest a marked reduction in the erythropoietic marrow which appears to be replaced by a gelatinous fatty material, presumably having no blood forming properties."

As a result of the above examinations it appears justifiable to assume that the cause of the death of this heifer was anaemia.

Heifer N., which calved on 12th November, 1934, showed very similar symptoms to N.11. She weighed 659 lbs. prior to calving, and had dropped to 590 lbs. on 1st March. By 20th March her weight had dropped to 569 lbs. and she was in a pitiable condition.

It was therefore decided to separate her from the other cows and to give her free access to the salt, iron, and copper lick.

The result was that she immediately began to improve in condition, and, although still feeding her calf, increased in weight despite the fact that by this time the quality factor of the grazing was progressively decreasing. By 29th May, after two months on the lick, her weight had increased to 650 lbs. She was successfully carried through the dry season without any supplementary feeding other than hay, and at the end of the year weighed 796 lbs.

The similarity in the symptoms of these two heifers leaves little doubt that both were suffering from the same deficiency disease, and the fact that the animal to which the lick was administered rapidly recovered is indicative of the efficacy of the lick under the above described conditions.

Revenue. The revenue from the Branch for the year ending 31st March, 1935, was as follows:—

Pasture Research Stations	£125	4	1
Services of Agricultural Chemists... ...	157	1	1
	£282	5	2

Travelling.—Lectures were delivered to eight Farmers' Associations and tours were made of farms in the Ayrshire-Sipolilo, Gwelo, and Hunters Road districts.

Nine visits were made to the Pasture Research Station, Marandellas, and six to the Matopos Station.

The Chief Chemist attended the Courts at Livingstone on two occasions as a professional witness for the Crown.

In conclusion, I desire to record my great appreciation of the loyal and efficient service rendered by my staff during the year.

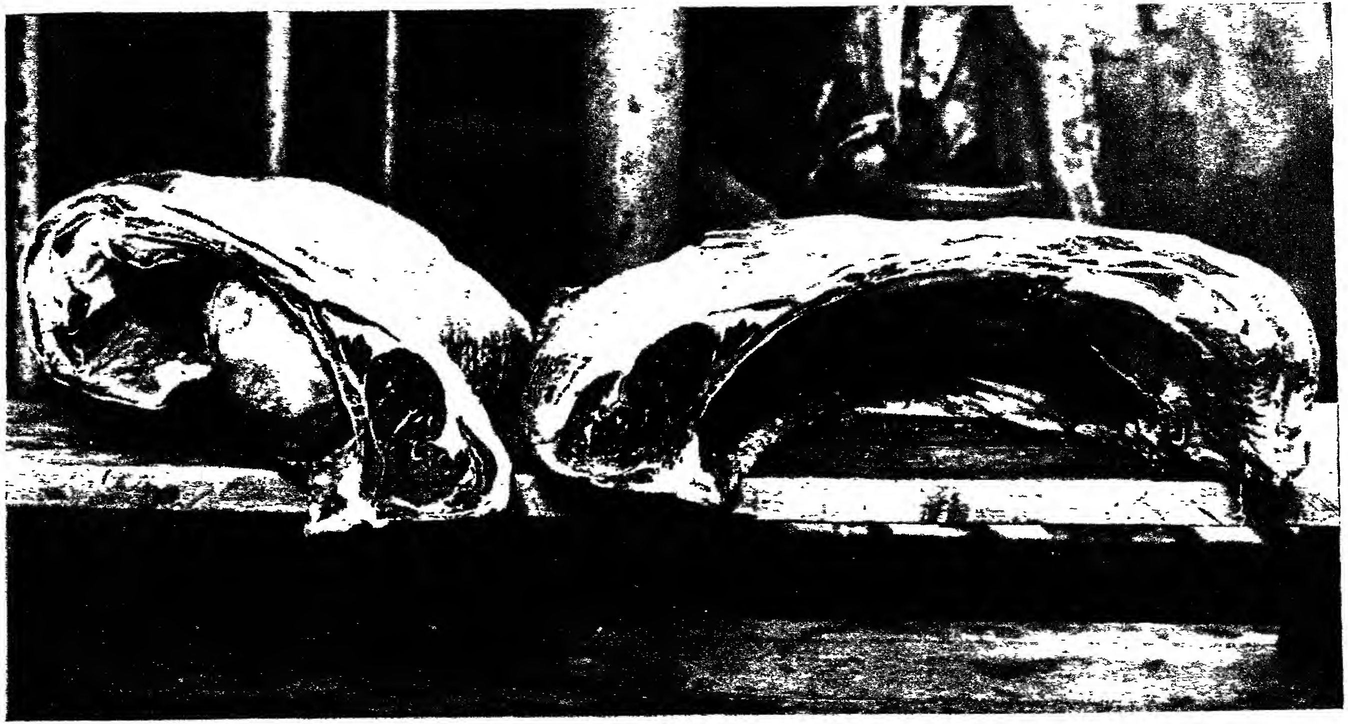


Fig. 2.—The eye pieces of the hind and forequarters appearing in fig. 1.

Fig. 1.—Hind and forequarters of chilled beef which were awarded first prize in their class at Smithfield.

The Qualities desired in Chilled Beef.

Division of Animal Husbandry.

The accompanying photographs of a side of chilled beef were forwarded to this Department by Lieut.-Colonel T. Dunlop Young, official advisor to this Department on veterinary and livestock matters in the United Kingdom.

They illustrate the carcase of a two-year-old crossbred Angus Shorthorn steer which won first prize in its class at the Wanganui Agricultural Show in New Zealand and which was again judged first by the trade when the consignment was re-judged at Smithfield.

The steer dressed out at 604 lbs. and the photographs of the beef give a good idea of a very useful side of beef for general purposes.

Figure 1 shows one side of the carcase after quartering and figure 2 the eye pieces of the same hind quarter and forequarter laid down in order to show how the side cut up.

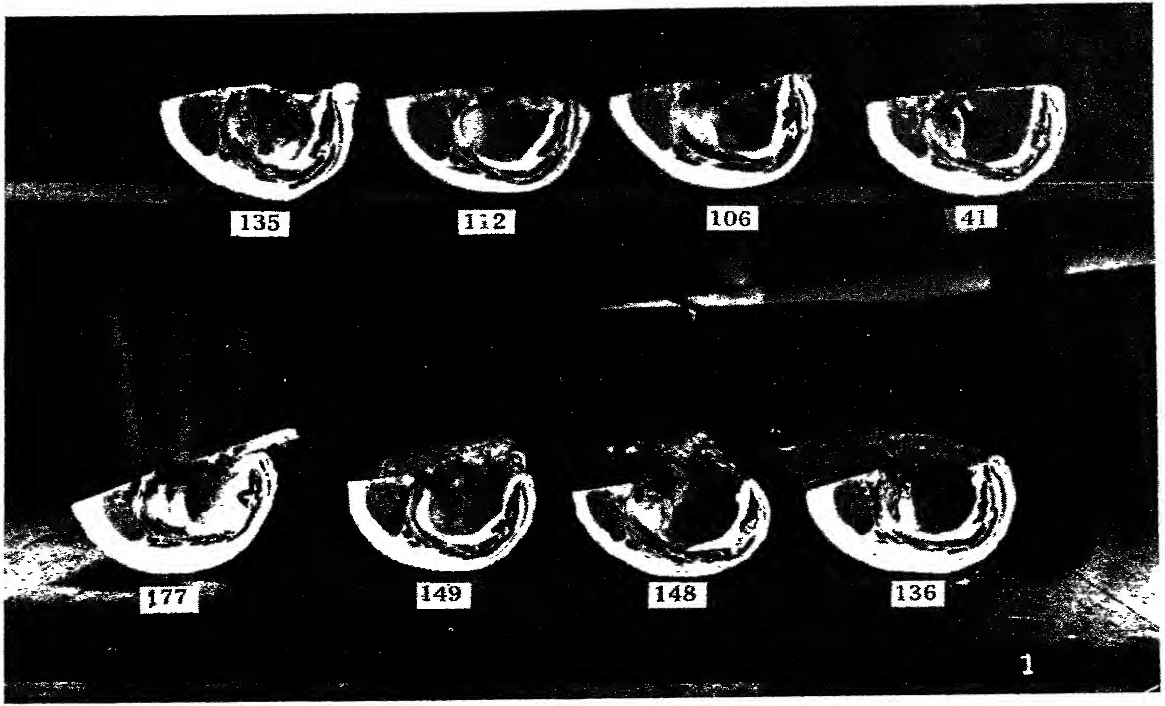
The side is not over fat, in fact some judges might think from the photograph that it was inclined to be "on the lean side for Smithfield." The general demand to-day is, however, for leaner beef than hitherto, provided the beef is sufficiently well covered with fat to give it the desired quality.

Attention is particularly directed to the quality of this carcase and to the even covering of fat along the back and side, over the crops and down to the hocks. The hindquarter is well rounded and full of meat which carries right down to the hock; there is no sign of "legginess." The hind flank is well filled. The forequarter is neat, light in proportion to the hindquarter and there is no trace of coarseness about the neck, which is a fault in many forequarters of

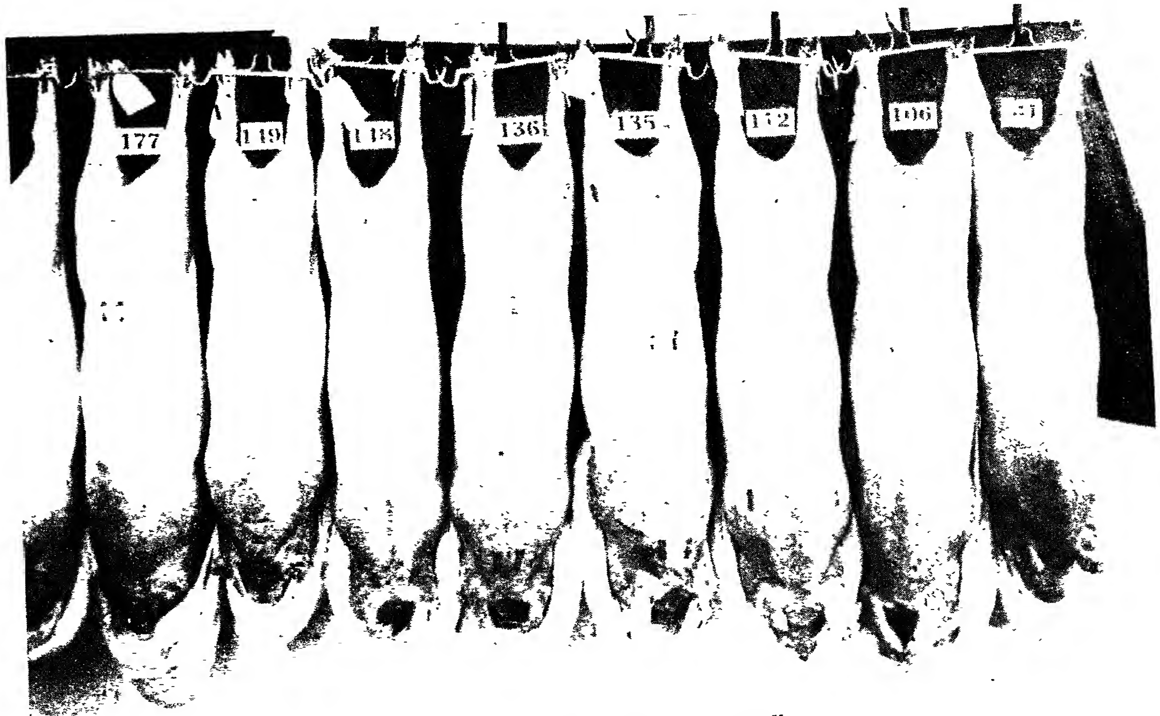
chilled beef from Rhodesia. There are no natural bare patches of lean meat showing on the sides, the one in the photograph being due to a surface abrasion in the handling of the beef.

The eye pieces show good marbling in the lean meat and an even covering of outside fat which is not too thick. The inside of the ribs appears to be covered with a thin layer of fat, which is taken as a sign that the fat in the carcase is well interspersed through the lean tissues. The ribs are well sprung and not too deep.

The whole carcase, except for the slightly faulty loin, is a good example of the commercial type of carcase that an ordinary breeder and feeder could produce all the year round.

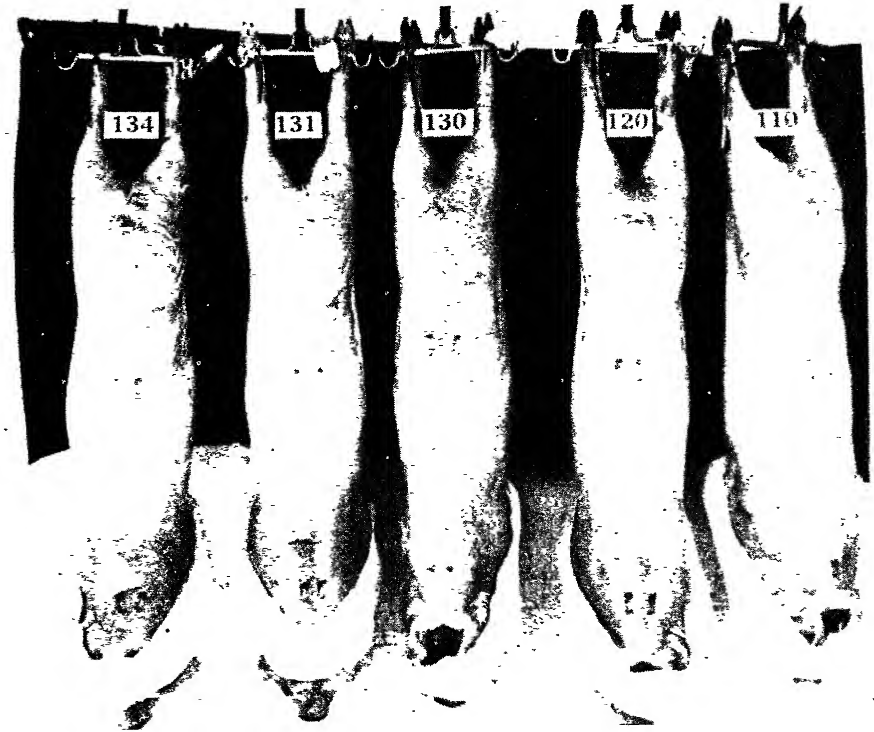


Pig No. 112 shows excellent cutting qualities.



A group of porkers which cut up well.

These porkers show excess fat.



A group of porkers which proved wasty when cut up.

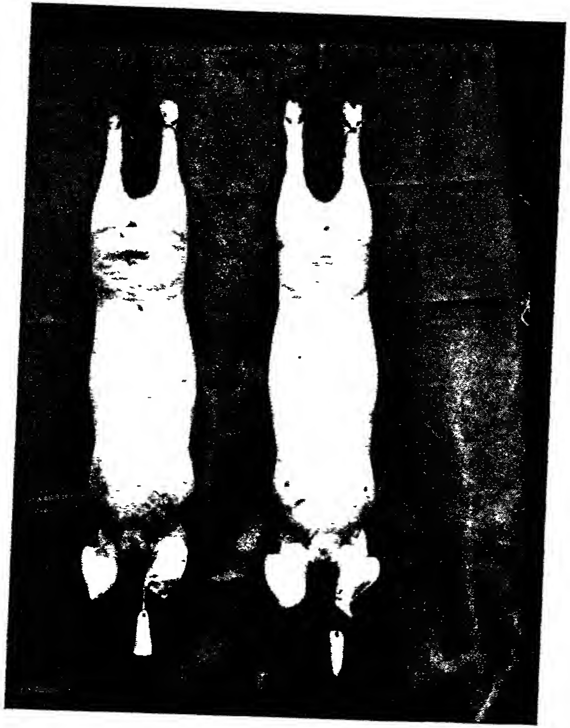


Fig. 1.—Two typical porkers at Bulawayo.

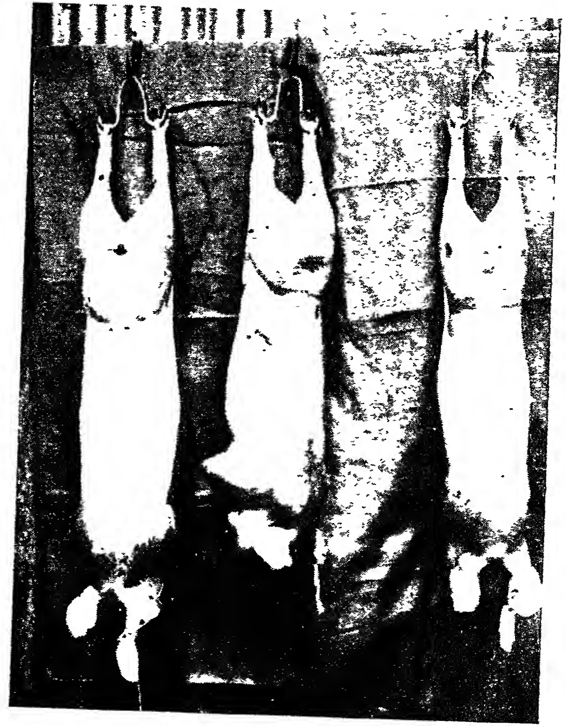


Fig 2.—Three rejects. Note the lack of finish in the two outside pigs.

Export of Frozen Porkers.

THIRD CONSIGNMENT TO SMITHFIELD.

Division of Animal Husbandry.

A summary of the report on the third consignment of frozen porkers which arrived in the United Kingdom at the end of January, 1936, is published herewith.

The consignment was examined from many angles and reports were received from Messrs. George Kean and Co., Ltd., The Imperial Cold Storage and Supply Co., Ltd., Mr. H. Wright, Colonel T. Dunlop Young, Dr. John Hammond and Mr. H. B. Davidson.

The shipment consisted of 89 porkers of different breeds and was planned to obtain information as to the suitability of the best of the general run of porkers produced in the Colony for the Smithfield market. The effect of different rations in use in the Colony on the firmness of the fat and the palatability and cooking qualities of the pork was tested at the same time.

The findings of the experts who examined the consignment and the comments of the Animal Husbandry Division of the Department of Agriculture on these various aspects are summarised in the different sections below.

Description of the Pigs.—Pigs of the following breeds and crosses were included in the consignment:—

Large White x Large Black.
Berkshire x Large Black.
Middle White x Large Black.
Tamworth x Large Black.
Large Black, pure.

In each case the breed of the boar is given first.

The pigs selected were considered typical of the crosses named. There is, however, so much variation within the different breeds and crosses that the results cannot, of course, be taken to apply to the breed or cross as a whole. The pigs were fairly well done, though the majority suffered some check at weaning and dressed out at an average of 76 lbs. at five months of age.

Report on the General Suitability of the Porkers.—The "trade" unhesitatingly placed the Large White x Large Black cross first, stating that "these were from a butcher's standpoint the best pigs of the whole consignment, being a very good run of porkers." This placing was considerably influenced by the smooth white skin of these porkers. In actual fact, on cutting up the pigs, the best carcase was given by a Berkshire x Large Black cross. The Berkshire x Large Black cross as a group scored slightly better than the Large White x Large Black cross, the next best. They were faulted, however, for their black skins and two cases of the objectionable "seedy cut" were noted. The Tamworth x Large Black cross was placed third. The Middle White x Large Black carcases were described as excellent in the thickness of lean meat, but overfat. The Large Blacks were wasty.

Figures 1 and 2 illustrate respectively what were considered two good porkers of the consignment and three rejects on the hooks at Bulawayo after slaughter. The two rejects on the outside were rejected for lack of finish and the one in the centre for lack of length, though it is also bruised.

Nearly all the pigs were described as being overfat for the amount of lean developed. The average quality was also considered somewhat below the New Zealand and Australian standard. Some pigs were considered very good. Breed, feed and management all probably play a part in accounting for the over-development of fat referred to. A potent factor in the case of this consignment is probably that the pigs were not done well enough as weaners, at the stage when lean meat and muscle tissues are developed.

The result of this experiment indicates that pigs, to make suitable export porkers, must be forced before and after weaning in order to encourage the development of the desired

proportion of lean meat. It may then be necessary to cut down on the feed in the last stages of fattening in order to prevent the pigs from getting overfat before reaching export weights.

In this respect it is important to see the pigs get ample protein, *i.e.*, separated milk, meat or blood meal, in order to encourage the maximum development of lean tissue.

The appearance and cutting qualities of the pigs is well shown in figures 3 to 6 of this report. Figures 3 and 5 show the porkers before they were cut up. Figures 4 and 6 show half of the cross section of each pig cut through at the last rib. Porker No. 112 in Figs. 3 and 5 was judged as the best porker in the consignment. It was a Berkshire x Large Black cross and scored a total of 81 points, which is a very high score. The development of the fat and lean in this pig is close to the ideal. Pig No. 131 in Figs. 4 and 6 was judged as the worst porker. It scored 29 points and is described as overfat and wasty. The porkers in Figs. 3 and 5 scored an average of 75 per cent. and 80 per cent. respectively of full marks for ham development and length of leg respectively. Those in Figs. 4 and 6 scored 63 per cent. and 20 per cent. respectively for the same points. The difference is very apparent as the pigs hang on the hook.

These illustrations were taken at random from the report to illustrate a good group when cut up and a bad one.

The summary of the scoring of these two groups is as follows:—

	Percentage of maximum points scored.						
	Hams.	Shoulders.	Streak.	Eye of loin.	Fat over eye.	Length of body.	Length of leg.
Group 1 (figs. 3 and 4)... ...	75	86	75	54	45	35	80
Group 2 (figs. 4 and 6)... ...	63	100	50	4	30	40	20

The standard set was a high one, and any pig which scores over half marks on any point is a good one in that respect.

The general report on the type of pigs is satisfactory considering the circumstances under which the pigs were raised. The sellers state that "if we had a continuity of supplies, we would soon build up a satisfactory butcher trade for this class of pig at prices exceedingly close to those of other Colonial pigs coming to this country."

The pigs realised from 5d. to 6d. per lb. with an average of 5.3d. per lb. The pigs were sold at the time of the Smithfield strike, when the market was unfavourable, and the splitting up of the carcases before the sale tended to depreciate their value somewhat.

Effect of Feed.—Four groups of pigs within the consignment were fed four different rations to determine the effect, if any, of these rations on the eating quality of the porkers and the firmness of the fat.

The rations used were:—

Group 1.—A rations made up in the proportion of maize meal 90 lbs., blood meal 8 lbs. cowpea hay 2 lbs.

Group 2.—One of maize meal 100 lbs., plus 1 gallon separated milk per pig per day.

Group 3.—One of maize meal 60 lbs., pollard 36 lbs., blood meal 4 lbs.

Group 4.—One of maize meal 60 lbs., cowpea meal 36 lbs., blood meal 4 lbs.

Each group received 2 per cent. of bone meal and 1 per cent. of salt in the rations and the pigs were fed as much as they would clean up.

Group 1 was looked upon as the control group. In Group 2 the blood meal was replaced by separated milk. In Groups 3 and 4 approximately one-third of the maize meal was replaced by pollard and cowpeas respectively.

A very careful report on each pig was made and the iodine number of the outer and inner fats determined. No significant difference between these groups was disclosed as the result of the ration. Group 1 (maize and blood meal) the control have, if anything, the best carcases, and Group 3 (pollard) the softest fat. There was a greater difference

between the breeds within a group than between the groups. There was no significant difference in rate or economy of gain between the different groups. As far as this trial is concerned the substitution of other feeds for maize or blood meal had apparently little or no effect.

Eating Qualities of the Pigs.—One critical reporter stated that "though the crackling and subcutaneous fat were sweet and satisfactory, the muscular tissues were rather dry and not very tender." He considered, however, that the dryness was due to the method of defrosting in this particular case; otherwise the joint would have been more juicy. All the other reports were to the effect that the meat was of a high quality and good flavour.

Recommendation.—It is suggested that chief attention in the future is required to work for thickness of lean meat without too much fat. This will require careful adjustment of breed, feed and management.

To this end it is recommended that rations comparatively high in protein be fed, that the pigs be forced after weaning on these rations and, if necessary, they should be allowed to go slowly towards the end of the feeding period so as not to get too fat.

The breeding sows should be selected on their performance and, as far as possible, only those kept which produce the type of porker required.

There is a decided preference for the white pig.

The report as a whole indicated that the quality of porker required can be produced in the Colony without difficulty and that it would realise a price very little inferior to other Colonial pork.

Annual Report of THE DAIRY BRANCH

FOR THE YEAR ENDING DECEMBER 31st, 1935.

By J. R. Corry, B.Sc. (Agric.), Chief Dairy Officer.

Dairying Season.—The dairying season 1934/35 was characterised by a rainfall which in total precipitation approximated the normal for the Colony. The season commenced with good rains in October and these continued during the following three months, only to be succeeded at the end of January by a period of drought, which lasted until well into March. This prolonged dry spell had an adverse effect on dairy production, particularly in Matabeleland, which was still suffering from the effects of the drought experienced during the previous season; in fact, very little rain was received in Matabeleland after the middle of January, with the result that the output of creamery butter over the territory as a whole barely exceeded that of the previous year, which was also a season of low production. The output of cheese on the other hand—the bulk of which is made in Mashonaland which suffered less severely from drought—exceeded that of any previous year by a very considerable margin and constituted a record for the Colony; the following figures show the production of butter and cheese during the period under review as compared with the output of previous seasons.

Production of Butter.
(Creamery Butter only.)

1931/32. lbs.	1932/33. lbs.	1933/34. lbs.	1934/35. lbs.
1,495,629	1,172,285	899,275	976,771

Production of Cheese.
(Farm and Factory Cheese—Cheddar and Gouda.)

1932/33 lbs.	1933/34 lbs.	1934/35 lbs.
259,442	250,193	337,345

Dairy Stock.—The treatment of dairy stock continues to receive attention and a definite improvement in this direction can now be reported; the provision of winter feed for growing stock and milking cows and the feeding of concentrates is rapidly becoming a more general practice.

Dairy stock are still in good demand and prices varying from £15 to £20 have been realised for good grade cows. It is gratifying to note also that the necessity for assisting farmers to obtain good dairy bulls to which reference has been made in previous reports has received the attention of the Government and led to the introduction of a "Live Stock Improvement Scheme" under which certain facilities in the form of monetary grant, etc., are made available to approved dairy farmers to enable them to purchase suitable bulls; this scheme, the response to which has been very encouraging, should prove of inestimable benefit to the dairy industry in improving the quality and standard of production of the Colony's dairy herds.

Milk Recording.—It is gratifying to be able to report that the milk recording scheme continues to be well supported; in fact, the interest displayed by farmers in this scheme has been quite a feature of the period under review and has led to a remarkable increase in the number of dairy herds and cows under test. The total number of herds recorded during the season amounted to 56 as compared with 44 in the previous year, or an increase of 27.3 per cent., whilst the number of cows tested reached the very creditable total of 2,285 as against 1,600 in the previous season, or an increase of no less than 42.4 per cent. The average annual production per cow in the grade herds tested is shown in the following. (These figures are compiled only in respect of cows which completed lactation by the 30th September, 1935, for the sake of comparison the figures for the previous year are given.)

	No. of Cows.	Milk Produced in lbs.	B.F. Produced in lbs.	Av. % B. Fat.	Av. No. of days.
1934	654	4,362.00	159.71	3.66	265
1935	1,183	4,180.00	148.00	3.54	265

The average production of the grade herds recorded during the period under review thus shows a slight decrease when compared with the figures for the previous year. This, however, is attributable partly to the unfavourable season which was experienced and also to the fact that most of the new herds which were brought under test—and whose yields are included in the figures referred to—showed a low standard of production which has depressed the general average; the latter is quite high, particularly in the case of some of the older and more established herds in which recording and culling, etc., has been practised for several years. The high average yield of some of these herds is shown in the following (these figures are compiled in respect of cows which completed lactation by the 30th September, 1935).

Owner.	No. of Cows.	lb. Milk Aver.	lb. B. Fat Aver.	Average % B. Fat.	No. of days.
R. R. Sharp . .	34	6,251.10	203.84	3.26	296
R. Fischer . . .	45	4,988.70	189.07	3.79	268
C. J. Orford . .	36	6,274.80	240.12	3.83	284
T. Meikle (Shangani)	81	7,119.20	250.17	3.51	286
F. Morrisby . .	50	5,185.00	185.39	3.58	349
Lamont Bros.	21	6,133.30	218.83	3.57	278

The above figures, which are very creditable and compare very favourably with grade herd averages in other dairying countries of the world, testify to the advantages to be derived from the milk recording service and indicates that the latter is proving of very great benefit to the dairying industry in the Colony.

Creameries.—Butter Production.—The number of creameries required to be registered under the "Dairy Product Act" stands at the same number as the previous year, *viz.*, eleven. Three of these concerns, however, *i.e.*, the Model Dairy and Kay's Creamery at Bulawayo and the Gwelo Creamery at Gwelo did not manufacture any butter during the period under review; the Gwelo Creamery is now used as a depot for the factory at Salisbury, whilst the other two concerns mentioned have not been operated as creameries for the past three years.

The question of reducing the number of creameries operating in the territory is a matter which has been very carefully investigated by the Commission of Enquiry appointed during the period under review to enquire into certain aspects of the dairy and pig industries, and the Commission's recommendations on the point, which have now been made public, will no doubt receive the very careful consideration of the Government.

As far as creamery extensions are concerned there is little to report. Messrs. The Midlands Dairy, Gwelo, have built a new butter room and are installing the necessary equipment for the pasteurisation of their cream supplies. These additions to their plant should make it possible for them to manufacture butter of very much better quality than has been made on these premises in the past.

The Salisbury Creamery has also extended its premises by the provision of an ice cream hardening room which was badly needed. No extensions are reported as far as the factories at Bulawayo are concerned. Messrs. The Rhodesia Co-operative Creameries, Ltd., however, have now disposed of their branch creamery at Francistown.

The continued existence of this creamery, however, which has unrestricted access to this territory's markets, is bound to create certain difficulties, as competition from this source can assuredly be anticipated.

As previously stated the creameries had a rather short season and production fell quite appreciably below the normal output for the Colony; as a matter of fact the creameries were faced at the commencement of the season with a shortage of "First Grade" butter, which had to be made good by importation from the Union, the total quantity of butter imported from that territory during the year under review amounted to approximately 18,000 lbs., practically all of which was "First Grade." Importations from the Bechuanaland Protectorate, consisting chiefly of second and third grade butter, amounted to approximately 46,000 lbs. There is little doubt that the importation of this butter—most of which had to be degraded—was unnecessary as the local creameries had adequate stocks of low grade butter to meet their requirements; as a matter of fact the introduction of the butter

referred to created a surplus of low grades which had finally to be exported overseas at the end of the season. Exports to the Union, Northern Rhodesia, Portuguese East Africa and the Belgian Congo amounted collectively to approximately 200,000 lbs., which is appreciably less than the quantity exported during the previous year. Bounties were paid by the Dairy Industry Control Board on exports to the Belgian Congo and Portuguese East Africa in order to meet subsidised competition from overseas, and as a result of this policy the creameries were enabled to maintain butter-fat prices at a comparatively high level; first grade butter-fat was maintained for the greater part of the season at the figure of 1s. 3d. per lb.—a price at least 4d higher than that ruling in the Union at the time.

The percentages of the different grades of butter manufactured show a slight improvement over the figures for the previous year, the figures are as follows:—

Year.	1st Grade %	2nd Grade %	3rd and under under Grade. Grade %
1933/34	58.20	21.78	20.62
1934/35	63.25	19.35	17.40

The percentage, however, of second and lower grade butter manufactured is still far too high and, unfortunately, the position is even worse than is indicated by the above figures, as considerable quantities of butter had to be degraded. During the season under review 4,896 cases of Rhodesian butter (the equivalent of approximately 260,000 lbs. of butter) were examined, and of these 2,197 cases, or nearly 45 per cent., were degraded. The details are as follows:—

Total No. of cases examined	4,896
Total No. of cases found to be of reputed grade	2,699
Total No. of cases degraded—	
1st—2nd	886
1st—3rd	374
1st—Below grade	7
2nd—3rd	373
2nd—Below grade	161
3rd—Below grade	396

Note.—(In addition to the above 1,361 cases of imported butter were examined and of these 640 cases were degraded.)

These figures reveal a very unsatisfactory state of affairs, particularly when it is borne in mind that a considerable proportion of this butter was degraded within two months of its manufacture.

Whilst the deterioration of this butter can be attributed in some cases to faulty manufacturing methods and defective storage, the fundamental cause undoubtedly lies in the quality of the cream and the conditions under which it is produced on the farms.

Cream Supplies.—As previously stated, the quality of the cream received at the Creameries shows little improvement over that produced in previous years. This is indeed regrettable, and it is feared that unless a very great improvement in this direction is effected it will be difficult, if not impossible, for our creameries to retain their share of the trade in the Northern and Eastern markets, which are rapidly becoming highly competitive. The introduction of corrective measures in the form of legislation under which some degree of control can be exercised over the conditions under which milk and cream is produced on the farm is imperative.

Testing and Grading of Cream.—Very few complaints have been received as far as the testing of cream is concerned. Considerable dissatisfaction has been expressed, however, by the producers in regard to the grades received for cream supplied to the creameries, but in practically every case that has been investigated it has been found that the cause of the trouble lay in the conditions, etc., under which the cream was produced and handled on the farm.

Cheese Factories.—Cheese Production.—The number of cheese factories required to be registered under the "Dairy Produce Act" during the year under review stands at the same number as last year, *viz*., seven. Of these only three are provided with refrigeration for the proper curing and storage of cheese.

As indicated elsewhere the total quantity of cheese manufactured showed an increase over that of the previous year and constituted a record for the Colony. The expansion which

has taken place has undoubtedly followed as a result of the high prices at which cheese has been maintained by the Cheese Stabilisation Association during the past few years.

Prices were fixed comparatively early in the season at 1s. 3d., 1s. 2d. and 1s. respectively for the three grades of cheese, with the result that milk which could be converted into *"Third Grade"* cheese was worth as much, if not more, per gallon than milk which was convertible into first grade creamery butter.

The policy of the Cheese Stabilisation Association in maintaining prices at the high level indicated has therefore made cheese making a much more remunerative undertaking than selling cream to a creamery and has resulted furthermore in the manufacture of an excessive quantity of low grade cheese inasmuch as producers were encouraged to manufacture this product from milk which in the ordinary course of events would have been separated and sent to the creamery. Figures in support of this contention are submitted hereunder.

Quantity of Cheese Graded in lb. and % of different Grades. (Cheddar only).

Year.	1st Grade lb.	2nd Grade lb.	3rd and below Grade. lb.	1st Grade %	2nd Grade %	3rd and below Grade. %
1933/34 .	121.970	91.252	19,030	52.70	39.20	8.10
1934/35 .	137,912	127,866	23,749	47.63	44.10	8.27

The gradings of 2nd, 3rd and below grade cheese during the period under review exceed those of the previous season by approximately 40,000 lbs.; the position is even worse than indicated above as, owing to the heavy accumulation of stocks, considerable quantities of cheese had to be degraded and these degradings are not reflected in the figures presented. Unfortunately also, a considerable proportion of the second, and even third grade cheese, was sold as "First Grade" and was invoiced to the consumer at the higher price. This is a

matter which requires immediate correction, for this practice, if allowed to continue, will only nullify the object of cheese grading and bring Rhodesian cheese and the industry generally into disrepute.

Legislation.—No legislative measures were introduced by this branch during the year under review.

General.—A development of considerable importance during the year under revision was the appointment of a Commission to enquire into certain aspects of the dairy industry with specific reference to the question of redundant creameries, the manufacture of farm butter, etc. There is little doubt that the Commission's recommendations on these matters, if put into effect, will prove of far-reaching benefit to the industry and will do much to establish the latter on a sound and economic basis.

SOUTHERN RHODESIA.

Locust Invasion, 1932-36.

Monthly Report No. 39, February, 1936.

The locust position has been quiet on the whole during February, but the Colony is not yet free from these pests. The only species recorded has been the Red Locust (*Nomadacris septemfasciata*, Serv.).

Winged swarms were reported throughout the month, the following districts being included, namely:—Charter, Mrewa, Victoria, Chibi, Hartley, Salisbury, Mazoe and Selukwe.

Hoppers have appeared in the districts of Mazoe, Hartley, Salisbury and Darwin. These have been, or are being, destroyed.

Amongst enemies, storks have been reported in large numbers following and attacking certain swarms, whilst the fly, *Stomatorhina lunata*, F., has been recorded attacking the eggs.

Neither parasites nor diseases of the adult locusts have been recorded. Humidity and rainfall have, in general, been above normal for the month, but were well below normal everywhere during December and January.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

JANUARY, 1936.

AFRICAN COAST FEVER.

Disease was diagnosed on the farm Nalire, Salisbury district, which adjoins the recently infected farm Sigaro. The mortality for the month being two head.

TUBERCULIN TEST.

Ten cows were tested upon importation with negative results.

MALLEIN TEST.

Twenty-six horses and three donkeys were tested. No reactions.

IMPORTATIONS.

From the Union of South Africa.—Horses 23, cows 10, sheep 1,714.

From Bechuanaland Protectorate.—Sheep 125, goats 25.

EXPORTATIONS.—MISCELLANEOUS.

To Union of South Africa.—Horses 3.

To the United Kingdom in Cold Storage.—Chilled beef quarters, 2,471; frozen boned beef quarters, 2,292; frozen beef quarters, 305; tongues, 943 lbs.; livers, 2,682 lbs.; hearts, 1,076 lbs.; tails, 538 lbs.; skirts, 606 lbs.; shanks, 2,894 lbs.

MEAT PRODUCTS.

From Liebig's Factory.—Corned beef, 21,600 lbs.

From Rhodesian Export & Cold Storage Co., Ltd.—Polony, 72 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

FEBRUARY, 1936.

Pressure.—Monthly mean pressure was considerably below normal over the whole country.

Temperature.—Monthly mean temperature was generally slightly above normal.

Rainfall.— Fairly heavy rains were recorded in most districts, the Falls area and the Eastern Border were below normal and the extreme north-east received excessively heavy rain. The average rainfall over the country amounted to 7.5 inches, nearly 2 inches over normal. This is the heaviest February rainfall since 1926. Recent February rains have been consistently small since that year, the normal has only been exceeded twice, in 1929 and 1936. The total rainfall for the season from October 1st amounts to 17.9 inches, about 5 inches below normal.

FEBRUARY, 1936.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	94	65	85.1	69.0	77.1	76.4	75.3	70.8	80	68	...	7.62	4.05	15	...
Beitbridge...	961.8	...	99	65	87.3	70.1	78.7	...	76.3	70.7	77	67	5.7	3.51	1.65	6	1,500
Bindura...	889.5	...	85	62	80.4	64.7	72.6	...	70.6	66.6	82	64	8.7	8.32	7.51	20	3,700
Bulawayo	866.8	867.2	87	54	80.7	61.3	71.0	70.3	68.6	64.3	80	62	7.4	6.90	3.99	15	4,426
Chipinga	890.6	...	86	59	77.0	62.6	69.8	..	70.1	66.4	84	64	7.0	6.00	7.40	20	3,685
Enkeldoorn...	855.9	...	85	55	77.9	61.2	69.6	69.7	68.1	64.0	80	62	6.7	6.97	6.15	19	4,788
Fort Victoria	893.1	894.0	88	59	81.0	64.5	72.8	71.5	71.0	66.8	81	65	6.4	12.31	4.75	19	3,571
Gwaai Siding	901.7	...	93	55	87.5	64.8	76.2	...	72.7	67.2	76	64	5.1	9.56	4.02	14	3,278
Gwanda...	904.1	...	90	60	82.7	65.1	73.9	..	70.7	66.7	82	64	7.0	3.67	3.69	14	3,233
Gwelo	860.6	..	84	54	79.6	62.2	70.9	70.9	68.5	64.3	80	62	6.2	8.42	5.33	18	4,629
Hartley...	883.3	...	86	57	81.3	63.9	72.6	72.3	70.9	66.5	80	64	6.6	9.96	7.27	17	3,879
Inyanga...	835.2	..	81	51	74.7	57.7	66.2	...	66.4	62.2	80	59	6.0	8.78	8.67	21	5,503
Marandellas	836.2	...	80	53	75.3	57.9	66.6	.	64.8	61.9	85	60	7.3	9.13	7.19	18	5,453
Miami	876.9	...	85	62	78.7	64.0	71.4	.	68.9	66.4	88	65	9.1	12.72	4.95	22	4,090
Mount Darwin ...	905.5	...	85	62	80.9	66.2	73.6	..	71.7	68.6	86	67	7.9	15.48	6.61	22	3,179
Mount Nuza	800.7	...	74	49	65.0	52.7	58.9	...	59.2	57.9	93	57	9.0	16.38	..	22	6,668
Mtoko	875.4	...	86	61	79.3	63.9	71.6	...	69.5	66.2	85	64	6.3	13.32	5.62	20	4,141
New Year's Gift. .	...	...	92	59	83.0	64.4	73.6	...	72.5	67.9	79	66	...	4.85	5.03	20	2,690
Nuanetsi	859.5	...	98	63	85.9	67.8	76.9	...	74.8	71.1	84	69	5.7	10.28	3.04	12	1,581
Plumtree	862.4	...	89	59	81.9	62.2	72.1	..	70.7	64.5	72	62	5.2	3.75	4.43	14	4,549
Que Que	879.8	...	87	57	82.1	63.8	73.0	...	70.2	66.0	81	64	7.7	5.70	6.72	13	3,999
Rusape	860.5	...	85	56	78.1	61.2	69.7	.	66.9	63.7	84	62	7.0	5.13	5.28	15	4,648
Salisbury	852.9	853.4	83	56	79.4	61.5	70.5	69.4	68.3	63.9	79	62	8.5	6.41	6.54	18	4,885
Shabani...	908.0	...	89	60	82.0	65.8	73.9	.	72.0	68.1	82	66	6.9	6.59	4.00	14	3,131
Sinoia	886.2	...	87	59	82.1	64.4	73.3	...	70.9	67.0	83	65	6.1	5.69	6.82	25	3,795
Sipolilo	883.2	...	84	61	78.9	63.9	71.4	...	70.2	66.1	82	64	8.0	8.96	6.97	23	3,876
Stapleford	840.6	...	80	46	72.4	56.4	64.4	...	63.9	61.9	90	61	7.6	16.81	16.91	21	5,304
Umtali...	890.7	891.5	89	58	81.0	62.9	72.0	71.5	70.6	66.7	82	65	7.8	8.80	6.08	17	3,672
Victoria Falls... ...	...	...	94	63	89.8	67.6	78.7	...	73.9	69.2	80	67	3.8	4.78	6.09	11	3,009
Wankie	924.4	...	96	67	91.2	70.9	81.1	..	77.0	69.9	71	67	6.3	3.04	4.73	12	2,567

Rainfall in February, 1936, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Total	N n
1	...	2	22	11	44	70	46	135	102	15	26	4	...	10	...	...	...	...	16	8	...	...	6	5	4	...	88	6	5	625	3
2	...	9	35	22	67	99	42	41	187	14	...	...	...	1	...	26	...	13	96	40	...	...	13	32	20	3	18	26	1	805	5
3	4	7	...	73	...	72	34	...	33	24	2	...	...	21	2	48	43	19	43	46	...	...	14	68	42	6	22	16	22	661	7
4	...	4	53	52	21	85	22	116	83	43	24	2	19	3	26	21	3	..	21	30	1	...	1	10	24	10	18	31	23	746	6
5	...	2	32	...	4	45	50	1	14	93	12	30	29	18	2	...	...	..	..	6	..	...	...	1	...	1	8	1	37	386	5
6	47	...	...	11	7	48	5	38	6	32	20	38	2	153	67	26	18	...	1	2	3	...	..	..	...	88	123	83	56	874	7
7	6	25	...	52	4	55	52	48	14	25	4	18	27	38	103	25	9	10	25	58	1	2	..	13	11	29	48	39	6	747	6
8	7	2	...	30	3	36	55	40	34	10	7	9	87	91	85	28	62	26	21	45	21	14	...	...	17	45	28	86	14	903	7
9	3	...	...	57	3	55	104	33	14	19	2	13	4	53	20	38	90	56	18	34	80	13	6	1	16	26	4	97	116	975	6
10	7	...	...	65	2	99	22	209	68	17	4	18	...	86	52	85	51	70	122	147	104	6	...	6	23	17	1	159	..	1440	6
Mean	7	5	18	28	21	65	46	64	60	34	12	15	13	42	29	21	20	14	29	30	17	3	4	8	11	20	42	44	32	754	5

Farming Calendar.

APRIL.

BEE-KEEPING.

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once.. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands:

irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 or 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial

control. The spray must hit the insect to kill. Do no re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growh may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Officers Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanliness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable from the Poultry Officers.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "Trichosoma contortum," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two table spoonfuls given for a dose.

STOCK.

Cattle.—Where winter conditions are good, early spring calves may be weaned now, but a common practice is to allow them to run with their dams until the early rains. Where supplementary feed is available, April to June are probably the best months of the year for cows to calve in. These months also suit the dairy farmer. Provide succulent feed for the dairy herd. Dry off cows which will not pay for a grain ration during the winter. Bullocks for winter fattening should be selected now.

Sheep.—The ewes should be kept in good shape for lambing. Put the big udder ewes on the green feed.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producing first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease.

MAY.

BEE-KEEPING.

Last month under normal conditions should have seen the last honey flow of the season almost ready for robbing, for which purpose have the extractor overhauled, spare crates available, bee escape boards ready, honey jars and bottles ready for usage, and also have a few spare quilts on hand. Do not rob the bees of too much honey, remembering that sending them into winter quarters with a sufficiency of food means a strong issuing colony in the spring. Any new swarms that it may be decided to add to the apiary, feed well if necessary, to induce stimulative breeding while there is time, or if new young queens have replaced older ones also feed liberally this month in the proportion of one part of cane sugar to two of water; for the somewhat wild Rhodesian bee there is nothing like the Alexander feeder let in from the back. Keep all the spaces under hive stands clean, also inspect daily to see that white ants are not building up from the soil; if this is neglected much loss may follow. When seen, sprinkle diluted kerol from a watering can under the hive stand.

Granulation in the bottled honey can be prevented by first ripening the extracted honey in large tins covered with butter muslin for three or four days by exposure to the sun's rays. It should then be heated to a temperature of 150-160 degrees—nothing higher. As soon as this is reached withdraw the tins and bottle when cooling. The best way to obtain this heating is to place the tins in another receptacle of cold water and boil it up to the required heat, as heating it direct over a fire is very liable to burn the contents or to impair the delicate flavour of the natural honey.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

CROPS.

Continue to cut and stook maize as it matures; make the stooks small to assist drying. Later in the season the stooks may be made larger. See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize. Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the dryer ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut within 2 to 4 inches of ground level. The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be lifted before the first frosts damage the hay. Finish transplanting onions

from seed-beds. If plants are not flourishing after transplanting, give a light dressing of nitrate of soda—50 lbs. per acre. Repeat in a fortnight if needed. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brick-making. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

DECIDUOUS FRUITS.

The pruning of early ripening peaches should be performed this month. All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse (aphis) and Bagrada bug during May. For the former wash the plants frequently with a strong stream of cold water from a spray pump, or spray with soap and tobacco wash. Transplants may be dipped in the latter. Plants attacked by Bagrada bug may be sprayed with resin wash when the young bugs are exposed in the early morning.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus coddling. Fumigate or spray for scale insects if necessary.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter. Collect fruit and destroy.

Tobacco.—Watch should be kept for the emergence of the adult wire-worm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20 to 30 gallons of water. The bait should be rolled into small balls and scattered on the lands, one ball to each ten square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 10 lbs. per 10 gallons. The bait is best laid in the evening.

Fields of tobacco found to be heavily infested with gallworm should be thoroughly ploughed and cross-ploughed and laid down to an immune crop next season.

Cotton.—Continue trapping and destroying stainers. All dropped bolls should be collected and destroyed.

Maize.—Clean up storage sites, sidings and sheds against weevil.

Potatoes.—Late potatoes should be kept earthed up to prevent tuber moth from attacking the tubers.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted.

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out coniferous seedlings into tins or beds. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

POULTRY.

All cockerel chickens should be separated from the pullets, and every month gone over carefully, the poorer ones eliminated and only the very best kept. Those cockerels with the deep long bodies, short legs and round heads should be kept. Those with any inclination to long legs, knock knees, long heads or thin beak, lop-over combs, narrow bodies, or those lacking length and depth should be rigorously discarded. The chickens must not be allowed to become chilled, especially at night; on the other hand, they must not sleep in a hot stuffy atmosphere. On no account must they be overcrowded; this is fatal and is one of the many rocks on which poultry keepers come to grief.

The young stock must have all they can eat; to stint them is to ruin them for good and all. A bird that has been stunted never recovers. A good quality bone meal (lime phosphate) is absolutely necessary, as is also plenty of succulent green food, and no animal protein is better than thick separated milk for the health and growth of the chickens.

Those going in for ducks should hatch according to the numbers they have to supply for eating each week. Ducks must have all the food they will eat from the time they are hatched. A quick-growing duck should put on 1 lb. per week and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the large wing feathers commence to grow.

If the rains have stopped, turkeys can be hatched. See that the youngsters are kept warm, but also that they have plenty of fresh air. Never feed young turkeys on wet or moist food, but give dry mash, grain, plenty of onion tops or onions chopped small, and thick separated milk. Keep them free from insect vermin; they will never thrive if they are infested with these.

Never allow the hen that has hatched the turkey eggs to run with the youngsters. Always confine her in a coop, through the slats of which the young turkeys can run in and out. The coop should be moved to fresh ground each day; nothing is worse for young turkeys than to be running on the same piece of ground for long at a time. Tainted ground is one of the chief causes of mortality among young turkeys.

STOCK.

Cattle.—By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding, and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies, and care taken that they are clean and sufficient.

Boggy sources of water supply are a frequent source of loss of cattle during the winter months. With adequate water supplies cattle can withstand considerable shortage of grazing. Weaners should be fed a good roughage ration—with or without a small allowance of grain, depending on circumstances—to keep them growing through the winter months.

Get in the bullocks for winter fattening.

Sheep.—The ewes should be lambing now. It is the general experience in the Colony that winter lambs are better than spring ones. Adequate feed must be provided to keep up the milk flow of the ewes. For this purpose a stand of winter oats or barley, on which the ewes can graze for an hour a day, is excellent. A little maize with a legume hay will also give very good results. Where roots do well, they will make a valuable succulent feed for sheep. The sheep should have access to some shelter from the cold winds. Dock the lambs.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already been commenced, should be no longer delayed. Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

During the major portion of this month the ordinary winter conditions prevail, viz., cloudless sunny days and cold nights. Frost may be normally expected at any time during the latter half of the month. There is often, however, a recrudescence of rain conditions during the early portion of the month, resulting in overcast days and light drizzling showers, the normal rainfall at many places, particularly in the southern and eastern portions of the country, amounting to over half an inch.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Chief Chemist and Assistant Poultry Officer attend Conferences.— Mr. A. D. Husband, Chief Chemist, and Mr. G. H. Cooper, Assistant Poultry Officer, both left on long leave towards the end of last month. Mr. Husband will attend the Commonwealth Scientific Conference in London during September and will also visit the Continent to make enquiries regarding fibre crops, essential oils, etc., on behalf of the Department. He is due back about the end of November.

Mr. Cooper will represent this Colony at the World's Poultry Conference at Leipzig during the latter half of July. He will return to duty at the end of September.

"Science Progress."—In the February number of this Journal an article by Dr. K. M. Smith was published entitled "Some Aspects of the Plant Virus Problem." The text of

this article was taken from *Science Progress*, a quarterly review published by Edward Arnold & Co., Maddox Street, London, W. The article referred to was given as an address to Section K of the British Association at its meeting at Norwich and was published with a number of excellent illustrations which were not, however, used in this Journal. Dr. Smith is a member of the staff of the Cambridge University Plant Breeding Institute and Potato Virus Research Station. Under these circumstances it was believed that the article was published for general scientific information, and as it had a distinct bearing on mosaic in tobacco it was republished in the Journal. The Department's attention has now been drawn to the fact that the rights of publication of the article had been given to *Science Progress*. Apologies and regret are therefore expressed to Dr K. M. Smith and the publishers of *Science Progress* that the article was reproduced in the Journal without first seeking permission to do so.

Second Growth Potato Tubers as Seed.—An interesting experiment was carried out at the Bangor University Experiment Station to study the value, for seed purposes, of second growth potato tubers. The general concensus of opinion is against the use of such seed, but the investigation is of particular interest to potato growers in this country because, in some seasons, there is a considerable amount of secondary growth. The main objection to their use is apparently due to the fact that such second growth tubers are immature and are, in consequence, more liable to rot in storage. On the other hand, the view had been expressed that the tubers would be likely to produce a more vigorous crop because they were immature. This has not proved to be the case, but the investigation now referred to seemed to indicate that although the resulting crop was not quite equal to that obtained from normal seed in quantity, yet the quality, on the whole, was better. It is considered that the loss in quantity was, in fact, almost compensated by the better quality, and that this result could be accounted for by the fact that there was less disease in the immature second growth seed than in the normal first growth mature tubers. We are

not aware of second growth tubers ever having been used for seed in this country, but should welcome any information which can be given on this point.

Oats the Most Useful Inland Fodder.—According to the *New South Wales Agricultural Gazette*, the crop that has proved the most useful for the production of fodder in inland districts is oats, which may be conserved either as silage, hay or grain. The early-maturing varieties that are available permit the claim being made that oats can be grown successfully wherever wheat is grown.

The practice that is recommended and is followed by some progressive farmers is to sow an early-maturing variety of oats early in the sowing period for early green fodder for grazing by lambing ewes and the production of fat lambs; these crops are grazed until July and August and then allowed to produce a crop of hay, the quality of which is ideal for sheep-feeding, the straw being fine and short and there being a large proportion of well-matured grain to straw. There is a saying to the effect that you cannot eat your cake and have it, but this practice is a near approach to proving it a fallacy.

Varieties of oats are now available which are particularly suitable for grazing, and after being grazed have good recovery power.

The varieties best suited to Rhodesian conditions and recommended by the Agricultural Branch are Kinvarra, Kherson and Sunrise.

Utility Maize Classes.—We record with considerable interest the decision of the Bulawayo Agricultural Show Society to provide a "Utility Class" in their maize section for their next Show and we hope that exhibitors will justify the step taken by entering exhibits and in this way make the class a feature of the maize section.

The fact that there are certain hereditary differences in strains of maize and in individual maize plants, and in their resistance or susceptibility to disease is highly important

from the standpoint of disease control and marked progress has been made in other countries in developing highly resistant strains.

Many Rhodesian farmers still carry out their seed selection in a superficial manner and fail to take into consideration the various characters which tend to indicate disease resistance and freedom from disease.

The "Utility Type" has been adopted generally to designate any open pollinated variety of maize that has been selected with particular reference to disease resistance of both plant and ear, and to an inherent capacity to produce satisfactory yields of sound grain. Any other standards, such as straightness of rows of kernels or uniformity of size and shape of the cobs are considered to be of minor importance in this class.

Plant selection is of value only in proportion to the care and intelligence with which it is carried out. A programme of selective breeding must of necessity be based on a period of years and full consideration must be given to all important points when making the selections.

It should be pointed out that this new class adopted by the Bulawayo Show Society also provides for any strains well adapted to local conditions (and "so-called" new varieties) which would not conform to the ""fancy show type" and which might not, therefore, satisfy the ideas which have been retained in regard to uniformity and other characteristics which have little or no commercial value.

The requirements under this class have been modified by the inclusion of 40 ears unhusked and complete with shanks in addition to ten breeding ears. This will provide a very good test of the exhibitor's ability to select for a definite object rather than for the usual Show characters.

SCORE CARD.—MAIZE.

Utility Classes.

40 Ears White, unhusked, and 10 Breeding Ears.

40 Ears Yellow, unhusked, and 10 Breeding Ears.

N.B.—Particulars of the variety or strain to be stated briefly. Exhibits must be staged with husks intact and with the complete shank (the stalk of the cob).

Points will be awarded as follows:—

	Points.
(*a*) Shank, short and incurved with clean break	15
(*b*) Husk, compact and firm on ear, apex of the ear well covered with the husk	15
(*c*) Freedom of disease (diplodia, etc.) and weathering...	25
(*d*) Kernel indentation and lustre, development of germ, length and diameter of ear and weight in proportion to size	45

These classes have been introduced to enable growers to exhibit definite types of maize which they have evolved to suit local climatic conditions and which may not conform to recognised breeds.

The objects of staging in the husk are:—

(1) to ensure that the exhibit as far as is possible is a genuine variety or strain evolved by the grower and not a few "sports" selected by the grower from the main crop.

(2) To demonstrate the necessary physical characters of a seed ear and the grower's ability to select desirable ears.

Bindura's Twelfth Annual Show.—We are in receipt of the Prize List of the Bindura and District Agricultural Society's Twelfth Annual Show to be held on the 25th July next. Situated in the heart of the maize belt and surrounded by enthusiastic growers Bindura has become the stronghold of the maize classes. A pleasing feature at their last Show was the keen competition in the Hickory King classes when no less than twenty entries were judged in each of these. We are assured by the Chairman, Mr. J. H. Farmer, that with the whole-hearted support of the farming, mining and commercial community we can look forward to a most interesting and successful Show.

Empire Exhibition, Johannesburg.—To eliminate district competition and the duplication of agricultural exhibits the Exhibition Committee have approved of a National Primary Exhibit, representative of Southern Rhodesia as a whole, to be staged in the Colony's Pavilion at the Empire Exhibition to be held in Johannesburg from the 15th September next to January 15th, 1937. Prize winning exhibits at the different Agricultural Shows will be gladly accepted by the Agriculturist of this Department, and it is hoped that these will be entered for exhibition at the Salisbury Show in August for final selection. Arrangements have already been made with the various tobacco organisations to ensure a comprehensive exhibit of some 6,000 lbs. weight of the commercial grades of Southern Rhodesian tobacco.

Demonstration and Construction of Contour Ridges.—All farmers and others interested are cordially invited to the demonstration to be conducted under the auspices of the Concession and Glendale Soil Conservation Sub-Committee at Devondale, Concession, on May 8th, 1936. Methods of constructing contour ridging by various implements will be demonstrated from 9 a.m. to 5 p.m.

Tea will be served at mid-day and in the afternoon, but visitors are requested to bring their own luncheons.

Farmers who wish to construct contour ridges are notified that three ditchers are available for hire at a charge of 1s. per diem, minimum charge 5s. Applications for the hire of these ditchers should be made to C. Tapson, Devondale, Concession.

Johnson Grass as a Noxious Weed.—Johnson Grass (*Sorghum halepense*), which is one of the most prolific perennial grasses, has been planted by a number of farmers in this country without considering the possible difficulties which will be encountered if it is desired to use the land so planted for other crops. It possesses strong creeping rootstocks which retain their powers of growth for a long time and which

penetrate the soil to such a depth that it is practically impossible to get rid of them. On this account Johnson grass has been proclaimed a noxious weed in several countries, including the Southern States of America and the Argentine. It was introduced into the Argentine more than thirty years ago as a forage crop, but was found to be such a menace to agriculture that special legislation was necessary to prevent its sale and to enforce measures for its eradication. This fact should not be overlooked when the planting of this crop is contemplated by farmers in this Colony.

The following note on the eradication of Johnson grass is taken from Professor Hitchcock's Textbook of Grasses:—

"Johnson Grass can be eradicated, but the process requires more care than in the case of most weeds. Ploughing in the fall with a turning plough, harrowing and removing the rootstocks, sowing the field to early-maturing grain, oats or rye, cut for hay in the spring, and following with a cultivated crop, will keep the grass in subjection. In the region where Johnson grass reaches its greatest development, alfalfa also thrives. Hence an excellent method to utilise an infested field is to sow alfalfa. This done in the fall after the field has been ploughed and harrowed to remove the rootstocks. The alfalfa soon smothers out most of the Johnson grass, and the hay is not injured by the presence of such of the latter as may remain. Johnson grass shares with sorghum the tendency to poison stock through the production, under certain conditions, of hydrocyanic acid."

Dr. Nierenstein's Visit.—Many tobacco growers will be interested to hear that Dr. M. Nierenstein is again visiting this Colony to discuss matters concerning tobacco research with the Tobacco Research Board and the technical staff of the Trelawney Station. Since his previous visit he has again visited the United States and Canada and submitted a very valuable report to the Imperial Tobacco Company, for whom his investigations were primarily conducted. A considerable portion of the report had a definite bearing on tobacco

research under Southern Rhodesian conditions and the Government extended an invitation to Dr. Nierenstein to visit us again and also undertook to pay part of the expenses incurred on the trip. The assistance of the Imperial Tobacco Company in arranging this visit is greatly appreciated.

Rhodesia Co-Operative Creameries, Limited, Bulawayo. The Rhodesia Co-operative Creameries, Ltd. of Bulawayo was in serious difficulties at the beginning of this year and sought assistance from the Land Bank to carry on its business. The fact that the Company as then constituted was not a co-operative concern as defined in the Land Bank Act made it impossible for such assistance to be given. The company was placed in provisional liquidation in February and a general meeting called, and the business advertised as a going concern. It is anticipated that a new company will be formed to carry on the business on real co-operative lines, and if this is assured the Government has authorised the Land Bank Board to provide sufficient capital to wind up the previous company and to enable the new one to carry on. We trust a truly co-operative business will be established and wish it every success.

Tetrachloride Risks.—The Queensland correspondent of the *Pastoral Review* writes:—

A report from Mr. F. H. S. Roberts, of the Animal Health Station, Yeerongpilly, on carbon tetrachloride, used as a drench for stomach worms in sheep, states that it has proved effective for the purpose, but cannot be regarded by any means as being safe; and in several instances its use had been followed by moderate to heavy mortalities.

The actual cause of the mortalities remained, in the majority of cases, undefined. So far as sheep were concerned, a calcium deficiency was known to be a predisposing condition to susceptibility, and by feeding a lick containing the necessary element for some time before drenching, the drug

might be given without any subsequent ill-effects. Other conditions which might be concerned with toxicity were said to be cold, bleak weather, a sudden drop in temperature after drenching, the feeding of concentrates, and hard feed.

There were many cases, however, which remained unexplained. Impure samples of the drug itself might be conducive to losses, but on several occasions in Queensland, in which losses had followed the use of carbon tetrachloride, a sample of the drug used had been proved to be pure, and moreover, its use on sheep on one station had not been followed by any untoward results.

At present there were no precautions which might be taken so that carbon tetrachloride might be used with safety. Cases were known where this drug has been used over a long period without any subsequent noticeable toxicity, and then, for some unknown reason, heavy losses occurred. These losses had become so serious that it was felt that the drug could no longer be recommended.

For sheepmen who still desired to use carbon tetrachloride it was most desirable that a small number of animals be treated a few days before the whole flock, and carefully watched for any ill-results, said Mr. Roberts. Even this precaution might not safeguard against losses, as one case was known in which two mobs of sheep on the same holding were drenched with the same sample of drug a few days apart. No symptoms of toxicity occurred in the first mob, but heavy losses were experienced in the second mob.

Locust Destruction Act, 1936.

Experience during recent locust campaigns and development of the use of aircraft against locusts had necessitated certain amendments to the Locust Destruction Ordinance, 1908. It was found that a number of minor alterations were also involved, and it was considered best to draw up an entirely new Act.

The main changes in the law brought about by the new Act are as follows:—

(1). It is now incumbent on any occupier of land to report to the nearest Magistrate's Office or Police Station or to the Department whenever locusts settle on or pass over his land (Section 4). Under the Ordinance occupiers were only required to report egg-laying and appearance of hoppers.

This lays a duty upon all concerned to keep the Department informed of locust movements. In the past, reporting of winged swarms has been purely voluntary, with the result that a few public spirited individuals have reported any swarms which have visited their land, whilst the greater majority of land occupiers have not. The intelligence thus secured has left much to be desired. Comprehensive information concerning the movements of swarms will be specially valuable if aircraft comes into extended use against winged swarms, and is necessary in any case for the purpose of preparing for and conducting locust campaigns.

(2). The Department is empowered to take such action anywhere against winged swarms as well as hoppers or locust eggs as it may consider advisable, or as may be prescribed by regulation, including the use of poisons. (Section 6). This merely extends the powers conferred by the Ordinance to include winged swarms and is intended to provide for the possible use of aircraft or other measures against the winged stage.

(3). The recovery from land occupiers of expenses incurred by the Department in destroying hoppers is provided for under Section 7. There is little alteration of the terms of the Ordinance in the case of European occupiers except that "all *reasonable* expenses" has been substituted for "all expenses." Such expenses are recoverable from the owner in default of a resident occupier, as in the Ordinance. The occupier or owner is protected against payment of expenses incurred by the Department if he can show that material was not available for carrying out destruction or that he made every effort in his power to destroy hoppers on his land before action was taken by the Government.

In the case of native occupiers the wording of the Ordinance has been altered to bring the Act into conformity with present native laws. Enquiries will be held by the Native Commissioner in the presence of the heads of the kraals concerned, and the records of such enquiries will be reviewed by the Chief Native Commissioner. The award of the Chief Native Commissioner on review will be executed in the same manner as the judgment of a Magistrate's Court in a civil action is executed.

(4). An indemnity clause has been introduced protecting the Department against liability for loss of or injury to, or destruction of, any animals, tree, plant, herbage, or other property caused by exercise of the powers conferred by the Act. (Section 8).

The occupier or owner is, however, protected in two ways. In the first place the Act does not alter the Common Law, and an occupier or owner can sue for compensation in any competent court for any loss or injury suffered by him if he can prove negligence on the part of an officer.

Secondly, the Minister in his absolute discretion is empowered to award compensation if he is satisfied that the loss incurred was due to negligence on the part of any officer, although absolute proof of such negligence may not be forthcoming.

This merely defines in the Act what has been the procedure in the past.

(5). Failure on the part of the occupier to report winged locusts, hoppers or eggs is made an offence under Section 9 (1), unless he can show that he made every effort in his power to comply with the law, or that he was ignorant of the presence of winged locusts, hoppers or eggs, and that his ignorance was not due to lack of reasonable supervision of his land.

Under Section 9 (2), failure to destroy hoppers is made an offence except in the circumstances already mentioned in connection with the recovery of expenses incurred by the Department, and in the case of ignorance not due to lack of reasonable supervision of his land.

Under Section 9 (2) it is made an offence to obstruct any officer in the execution of his duty or to fail to disclose any information required by an officer as to the presence or movements of locusts, hoppers or locust eggs.

(6). It is made an offence under Section 10 if any occupier of land to whom any material or apparatus has been supplied by the Department:

(a). Applies such material or apparatus to any other purpose; or

(b). Wastes any such material; or

(c). Uses the material at a strength greater than that directed by the Department, unless authorized in writing by an officer of the Department to exceed such strength; or

(d). On the demand of the Department or any person authorized by the Department for the return to it of any apparatus lent by it, fails to return it forthwith, or when the return of such apparatus is impracticable, fails on like demand to pay for the same forthwith.

The provisions of this Section are highly necessary in view of the too frequent occurence of the irregularities guarded against under sub-sections (a), (b) and (c), and the difficulty at times experienced in securing the return of locust pumps, issued on loan to land occupiers.

The use of locust poison at too great a strength is the most frequent offence of all. It is unnecessary, wasteful of material, and increases the danger to grazing animals.

(7). Under Section 12, it is made an offence if any officer contravenes or fails to comply with any regulations regarding the supervision and safe use of poison entrusted to his care for the purposes of the Act.

Preparing Cattle for Show.

By The Animal Husbandry Division.

Reasons for Showing.—Probably the most important reason for showing cattle is to advertise the breeder and to sell breeding stock, especially bulls. Any stock shown should therefore be in such condition and so selected as to be an advertisement to the breeder and not call for explanations, as is sometimes the case, as to why the animals are so small or in such poor condition.

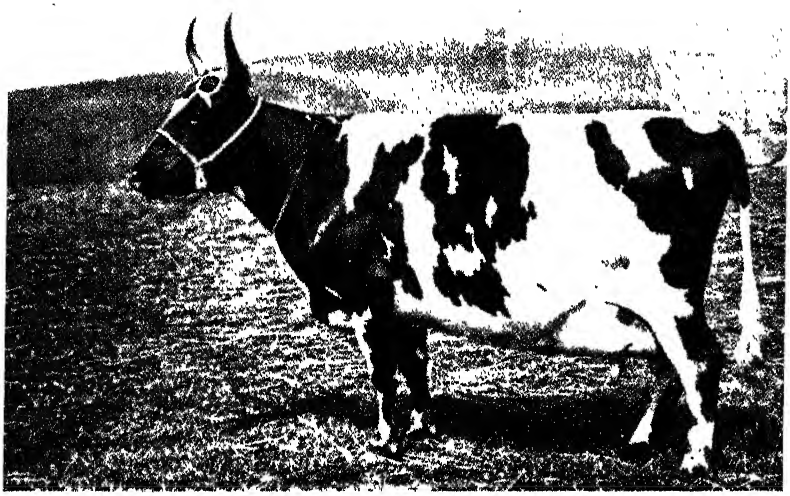
Choice of Stock.—The choice of stock for show must be made well in advance. The Show catalogue should be carefully studied before making a selection. Nothing is so disappointing as to find out at the last moment that certain animals are not eligible or cannot be shown in the classes desired.

Cows for exhibition should be selected if possible a year in advance. They should be bred to calve a few weeks before the Show. By this plan each cow should be at her best, with a large udder and have a few weeks in which to recover from freshening. This is particularly important with dairy cows.

With young bulls and heifers such long preparation is unnecessary. They should be selected so as to be as near the maximum age as possible for the class in which they are to be shown. Well grown animals generally have the advantage over smaller ones in the same class.

Feeding.—Animals should be shown in good flesh, not overfat, but smoothly covered and firm. Animals in poor condition should not be shown. Overfatness is dangerous and many valuable breeding animals have been spoilt as breeders by overfattening for Show.

No particular system of feeding is necessary. The animals should receive good treatment using the rations available. The quantities fed should be kept well within the limits of the



An Ayrshire cow well fitted and correctly posed.
(Taken from the Ayrshire Cattle Society's Journal.)

appetite. Overheating feeds such as an excessive amount of maize should not be used, especially in hot weather. Linseed meal is particularly valuable in fitting animals to improve the handling qualities of the hide. Failing linseed meal, ground nut cake makes a good substitute. Bran is another valuable feed at this time on account of its laxative and cooling qualities. A useful concentrate ration for fitting cattle is maize meal 300 lbs , bran 100 lbs., ground nut cake 150 lbs. Ground sunflower head and seeds makes a fair substitute for bran. The quantity of roughage feeds such as silage, veld hay and pumpkins should be limited somewhat in the case of bulls in order to guard against the over-development of paunch.

Exercise.—The animals should get plenty of exercise. As far as bulls are concerned most of this exercise should be obtained by leading them. In the case of heifers and cows a good portion of the exercise should be obtained in the same way. It is only by training the animals to lead well and to stand squarely with the head held erect that a really good impression can be made in the Show Ring. Patience at this stage is well repaid later and much trouble should be taken to teach an animal to lead and to stand well. The correct stance should be got by patiently pushing the animal backward or forward or touching the misplaced foot gently.

Any cow, heifer, or young bull should be thoroughly halter-broken before it is taken into the ring and be accustomed to the usual handling given it by a judge. Old bulls should lead quietly on a stick.

Stabling.—The animals should, if possible, be stabled for a couple of months before showing. They should be washed and scrubbed with soap and water and the coats thoroughly rinsed. To secure the maximum suppleness of skin they should be lightly blanketed for the last six to eight weeks. They should then not be allowed to remain out of doors in the sun without blankets, except when being exercised. The blanket protects the animal from flies and improves the hair and skin. Linen or ordinary sacking make useful blanketing materials.

The animals should be groomed daily. Grooming improves the coat and promotes health. The brush used should not be hard and a curry comb should be used very sparingly except to remove dirt or manure If the animal is well bedded at this stage much cleansing will be saved. As a final touch after each grooming the coat should be smoothed off with a cloth.

The animal should be washed periodically and during the last two weeks it can be washed to advantage every third or fourth day, as washing followed by blanketing aids greatly in producing a loose pliable skin. A good quality soap should be used. Persistent manure stains on white animals can be removed fairly effectively by plastering the stains thickly with a paste of finely ground charcoal and water which is brushed off thoroughly when dry. More than one application may be necessary. The hair should be clipped where necessary well in advance of the Show. The clipping required varies with the breed and quality of the hair and hide. In most breeds the hair round the face, withers, tail head, neck and tail, except the switch, is clipped. In dairy breeds the coarse hair on the udder is often clipped away, except the long hair on the milk veins, which should be left intact to emphasise the veins. Clipping a few weeks before the Show allows the hair to grow out somewhat and the coat looks softer.

Care of Horns and Feet. -If sufficient time is available the horn should be trained to grow out in the correct way for the breed. This is generally done by attaching cylindrical weights which screw on to the tops of the horns, where it is desired to bring the tips down, or by hanging a weight over a pulley over the beast's head, where it is necessary to "cock the horns up."

It is necessary to be gentle and gradual in this bending of the horns. The start should be made when the horns are young, and inexperienced breeders should consult a practical showman of the breed before starting to modify the horns. A month or two before the Show the horns should be smoothed with a rasp and then scraped lengthwise with a piece of glass

until nearly smooth. They should then be finished off with fine sandpaper or emery cloth. The horns should then be frequently polished with a mixture of powdered pumice stone and sweet oil until the time of the Show.

It is often difficult to trim the feet properly unless the animal has been trained so stand quietly or is thrown. For this reason the feet are often neglected. It is not uncommon to see a really good animal turned down for bad feet. The hoofs must be trimmed to be symmetrical. This can be done with a hoof knife, rasp, chisel and mallet. After trimming the hoof should be rasped smooth. After the final smoothing the hoof may be oiled and rubbed to a polish.

Transport to the Show and on the Show Ground.—The ration should remain the same at the Show Grounds as on the farm. Wherever possible arrangements should be made to send the home feeds with the animals.

It is a good plan to arrange for the animals to arrive at the Show Grounds at least two days before the Show so that they can settle down and the final preparation can be made with plenty of time in hand.

The night before showing the tails should be washed and blued if white. They should then be braided into three or four small braids and left overnight. When ready to show open up the plaits and brush out the tail, thus giving it an attractive fluffy appearance.

Just before showing the use of a *very little* sweet oil or a mixture of equal parts sweet oil and alcohol on the cloth with which the final smoothing of the coat is to be recommended with smooth coated breeds. In beef breeds and breeds with long coats the final conformation may often be improved by brushing up the hair in parts, just before entering the ring, with a damp brush or a curry comb so as to cover hollows or smooth the outline where desired.

If the cattle are not drinking freely they may be induced to take a full drink if given salt the night before.

When in the ring the animals should be handled to show them off to the best advantage and catch the eye of the judge. Any attendants leading the cattle should be dressed cleanly and neatly.

Wines from Tropical Fruits.

By S. E. Stephens, Northern Instructor in Fruit Culture.

(Reprinted from the *Queensland Agricultural Journal.*)

At times every orchadist has a quantity of fruit which, owing to some slight superficial blemish, or perhaps because it is too ripe to pack, is unfit for market. Such fruit is usually discarded and goes to waste. Some, at least, of this could be turned into a profitable commodity by converting it to wine.

The process is a simple one, but to be assured of success the producer must not be impatient to achieve monetary results. The secret lies in proper fermentation and lengthy maturing. Although some of the recipes given below stipulate a few weeks or months in the wood, an improvement in quality would be obtained by allowing twelve months for maturing before bottling off

The process is essentially the same with all fruits. Variations in the processes with any one kind of fruit are largely a matter of individual fancy, as, for example, the adding of brandy or rum after fermentation. Whilst it is my opinion that this definitely improves the wine, some may hold a contrary opinion and prefer to omit it. Indeed, many of the recipes do omit it.

Before proceeding to detail a few recipes the following general remarks, which apply to all wine making, may be made.

Firstly, only wood or earthenware vessels should be used. Wood is preferable. Under no circumstances should a vessel of iron or any other metal be used.

Secondly, the vessels used must be perfectly clean.

Thirdly, during fermentation the cask must be filled daily almost to the bung hole from a small quantity retained

for this purpose. If this should be all exhausted before fermentation is complete clean cold water must be used. Fermentation usually takes about three weeks.

Fourthly, throughout the whole process and while the wine is maturing in the wood the temperature should be as even as possible, and around 60 deg. Fahr.

The following recipes have been collected from various sources. Several are personally known to the writer to produce good wine, whilst all are reputed to be good. Quantities may be increased or reduced in proportion, according as it is desired to make a greater or less quantity.

Orange Wine No. 1.—Squeeze sufficient oranges to make 2½ gallons of juice. Add 25 lb. of sugar. Put the orange pulp into a separate tub and cover with cold water, allowing it to stand for twenty-four hours. Then strain and add the liquid to the juice and sugar. Add more water, if necessary, to make the quantity up to 10 gallons of liquor, and let stand for twenty-four hours. Then strain off and fill cask. Keep cask filled with additional liquor or cold water, and when fermentation is complete bung up and set aside for twelve months.

Orange Wine No. 2.—Put 40 lb. of sound, peeled oranges into a well-cleaned wooden tub or vat. Bruise the fruit and pour over it 4 gallons of water. Stir the whole thoroughly and work the fruit with the hands until the juice and pulp is separated from the pith and rag. Then allow it to stand for twenty-four hours. Strain through a coarse cloth with gentle pressure. Wash the mash with a gallon of clean water to remove any remaining soluble matter and strain it through into the other juice. Dissolve 25 lb. to 30 lb. of sugar in the liquor and then add sufficient water to make up to 10½ gallons. Cover the vat with a blanket and board, and allow to stand twelve to twenty-four hours, according to the state of the fermentative process. Draw off into a cask, filling almost to the bung hole, so that the scum may overflow as fermentation goes on. Add a little liquor daily to keep the level just below the bung hole. When fermentation is almost complete knock the bung in tightly and bore a small gimlet hole in

the side, pegging it lightly. Remove the peg from time to time to allow the gas to escape. When the gas escape is so feeble that it will not extinguish a lighted match the peg may be knocked home. Then add a tablespoon of isinglass to fine the wine, and in a few weeks it will be fit for bottling.

Orange Wine No. 3.—Dissolve 15 lb. of loaf sugar in 4 gallons of water over gentle heat. Add the whites and broken shells of three eggs. Bring to the boil and then reduce the heat so that the syrup only simmers. Remove from the fire after twenty minutes, and when nearly cold strain into a large tub. Squeeze and strain the juice of fifty large seville oranges. Stir it into the syrup and add three tablespoons of brewer's yeast. Cover with a cloth and leave for at least twenty-four hours. Pour into a dry cask and leave loosely bunged until fermentation stops; then tighten up and leave for three months. At the end of that time prepare another cask and draw the wine off into it, at the same time adding a pint of brandy. Bung down, and after twelve months bottle.

Mango Wine No. 1.—Choose very ripe fruit. Put them in an earthenware vessel or cask without removing either the skins or seeds. Cover with water and allow to stand for three days. Stir or squeeze the fruit three times a day until the flesh leaves the seeds. At the end of this period strain the mash through a fine cloth and measure it. To every gallon of juice allow 3½ lb. sugar. When this is dissolved pour the wine into bottles, but do not cork them. Allow to ferment, each day filling the bottles with liquor retained for the purpose. When fermentation stops cork the bottles and put them away. The longer this is kept the better it becomes.

Mango Wine No. 2.—Select ripe fruit and place them in a wooden tub or cask with one end knocked out. Bruise the fruit well and pour in 1 gallon water for every 10 lb. to 12 lb. of fruit. Let stand for forty-eight hours, then strain and measure into a cask. For every gallon of liquor add 2 lb. to 2½ lb. of white sugar, according to the sweetness of the fruit used. Set aside to ferment, and when this is complete add ½ pint of rum or brandy for each gallon of wine and bung down tightly. After nine to twelve months bottle it off. The wine will be fit to drink in about six months, but if kept longer it will be better.

Granadilla Wine.—To make 5 gallons of wine mash ten medium-sized granadillas, fully ripe, and well cover with water in an earthenware or wooden vessel. Let stand forty-eight hours, then strain off Dissolve 10 to 12 lb. sugar in hot water to make up $5\frac{1}{2}$ gallons of liquor. Pour into a cask and keep the extra $\frac{1}{2}$ gallon aside for filling as the fermentative process reduces the level of the wine each day. When fermentation is finished, which should be in about three weeks, 2 pints of brandy may be added and the bung driven in. The wine may be bottled off in nine to twelve months.

Pineapple Wine.—Mash 10 lb. ripe pineapples, including the skins, and cover with 2 gallons water. Let stand twenty-four hours, to forty-eight hours, then strain off. Add 6 lb. sugar and stir till dissolved, then strain off into a keg or earthenware demijohn. When fermentation is complete seal down. The wine may be bottled off after six months.

Mulberry Wine.—Use quite ripe fruit, and to every pound of mulberries add 1 gallon water. Stir well, and leave for twenty-four hours. Strain, and to every gallon of juice add $3\frac{1}{2}$ lb. sugar. When dissolved put the liquor into a cask. When fermentation has ceased bung tightly. Three months later the wine may be bottled off, adding three cloves and a lump of sugar to each bottle. It should then be stored away for a year.

Strawberry Wine No. 1.—To 1 quart of strawberry juice add 1 quart of water and 1 lb. sugar, and stir well. Strain and allow to ferment in an open jar. When fermentation is complete, draw off and bottle. Set the bottles aside for at least six months.

Strawberry Wine No. 2.—Take $3\frac{1}{2}$ gallons cold water, 3 gallons cider, and 3 gallons strawberry juice. Ferment, then add 8 lb. sugar, $1\frac{1}{2}$ oz. red tartar finely ground, juice and rind of one lemon, and 1 quart of brandy. This will make 9 gallons of wine. For strawberry wine the fruit should be picked in fine weather after several fine days.

Raspberry Wine.—Gather the fruit when quite ripe, bruise and strain the juice through a bag. Boil the juice in an enamel pan, and for every gallon add $1\frac{1}{2}$ lb. sugar. Also add the whites of one to three eggs, according to the quantity

to be made. Let this boil for fifteen minutes, skimming it as the froth rises. When cold and settled decant into a cask, adding a bottle of yeast to aid fermentation. When this is complete add 1 pint of white wine or ½ pint of proof spirits to each gallon, and hang in the cask a bag containing 1 oz. of bruised mace. Keep the cask in a cool place. The wine should be fit for use after three months.

Rosella Wine No. 1.—Put the fruit into a wooden tub and pour over it boiling water rather more than sufficient to cover it. Let stand for three days, stirring now and then. Strain off and measure. For every gallon of juice take 3 lb. of sugar and make into a thick syrup with boiling water. Pour this into the juice while still hot and stir well. Pour into a cask, filling almost to the bung hole, and allow to ferment. If fermentation does not start within twenty-four hours add a bottle of yeast. When fermentation is complete, bung up and leave for three months, when it will be ready to draw off and bottle.

Rosella Wine No. 2.—To 1 gallon of rosella add 1 gallon of water. Let stand twenty-four hours, then add 4 lb. sugar, ½ oz. allspice, ½ oz. whole ginger, ½ oz. cloves tied in a muslin bag. Boil steadily for one hour, then strain off. When cold, bottle, seal, and put away in a dark place for six months.

Raisin Wine.—Take 10 lb. raisins and 1 lb. sugar. Pick the raisins clean and chop them fine. Pour 1 gallon of hot water on them and press the juice through a bag. Let stand for twelve hours, then add the sugar and leave to ferment. When fermentation is complete cask and bung up. After three months draw off into another cask and bung it closely. Bottle off in ten months, and it will be fit to drink in a year.

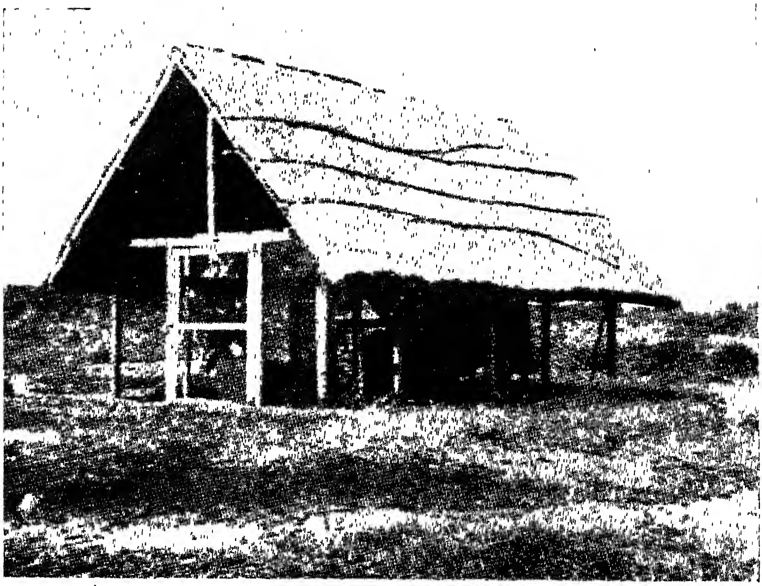


Fig. 4. Typical Kenya drying shed.
(Photo from an official report.)

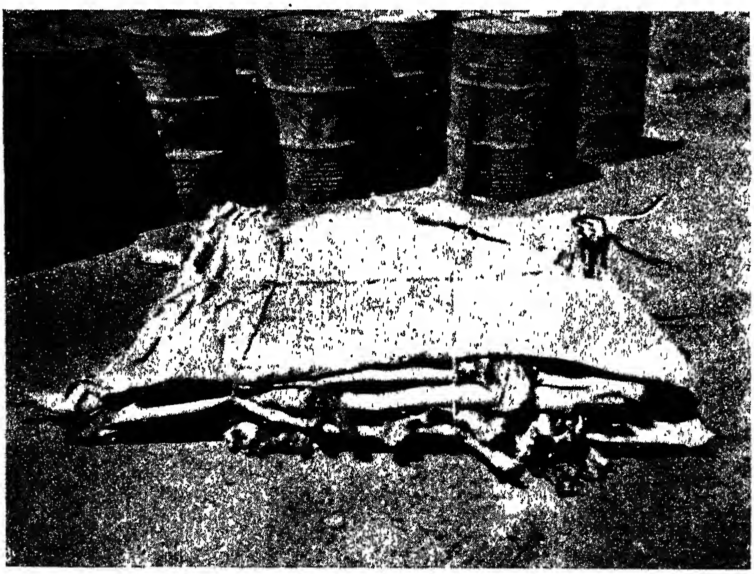


Fig. 5. A well made up bundle of sun-dried hides.

Fig. 2 Hides sun-cured by a method recommended by the Imperial Institute.

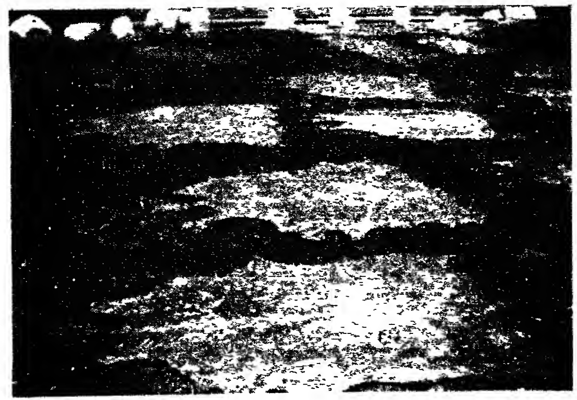


Fig. 3. Hides sun-cured on the ground in the ordinary native way. These hides were valued at 3d. per lb. less than those in fig. 2.

Fig. 1. Hides that have been ruined by the method of curing.

The Curing of Hides and Skins on the Farm.

By The Division of Animal Husbandry.

The export of hides is a valuable source of income to the Colony. In many cases the hides, if properly cured, represent 25% of the value of the whole beast. The weight and the value of hides exported in the years 1930-35 inclusive are given in the following table:—

A.—Quantity.

Article.	1930. lbs.	1931. lbs.	1932. lbs.	1933. lbs.	1934. lbs.	1935. lbs.
Hides, Cattle, dry	3,488,038	2,252,324	1,716,985	2,174,495	3,283,794	3,023,370
Hides, Cattle, wet	299,254	108,970	80.553	1.974,570	2,903,710	4,042.707
Skins, Calf	31,460	65,440	4,052	16,298	46,875	83,348
Skins, Goat	40.764	5,791	—	—	6,448	55,615
Skins, Sheep	123,000	60,854	1,542	253,550	25,380	28,385

B.—Value.

Hides, Cattle, dry ...	£78,717	£43,657	£29,987	£28,637	£47,444	£33,565
Hides, Cattle, wet ...	5,279	1,890	1,445	28,932	41.302	69,568
Skins, Calf	856	2,020	66	241	638	1,133
Skins, Goat	1,408	149	—	—	187	893
Skins, Sheep	2,290	1,325	19	4,738	567	479

Unfortunately the bulk of our farm cured and native hides do not realise their full value, because they are often:—

1. Badly cured.

or 2. Badly flayed,

or 3. Show excessive branding and often much horn damage as well

It is estimated that the loss, at to-day's prices, on hides cured from cattle, slaughtered for local consumption, is at least £20,000 per annum. To this loss can be added the derelict hides lying under a tree or in a shed being gradually

demolished by insects which is a familiar sight to every farmer. Most of these derelict hides never reach the market at all. Fig. 1 shows a few of these badly cured hides.

Despite all these criticisms, Rhodesian hides are intrinsically of high quality. In a report on a mixed consignment of Rhodesian hides received from the Advisory Committee of Hides and Skins of the Imperial Institute, it is stated that—"the examination of the leather has shown the hides used in these experiments to be of excellent quality as regards leather-forming properties. The defects present, and to which attention has been drawn, are those due to preparation and handling. The hides when properly taken off and treated should be of a high class quality."

In this consignment there was a difference of no less than 3d. per lb. between the hides cured in the ordinary native way (Fig. 3) and hides cured properly by "sundried or shade dried methods," and the purpose of this article is to show how a hide should be cured on the farm so as to eliminate the defects generally referred to and to make this extra 3d. per lb. or 5s. to 6s. per hide. A summary of this report was published in the *Rhodesia Agricultural Journal* of April, 1936. Reprints of this summary can be obtained from the Department of Agriculture.

1. **Slaughtering and Flaying.**—Slaughtering should be carried out on a grassy spot and the blood should be allowed to flow away from the carcase, and not dirty the skin. The entrails should not be handled on or left lying on the skin. Flaying should be done carefully and a proper flaying knife with a button on it to prevent scoring should be used. Information as to the names of the firms that supply these knives can be obtained from the Department of Agriculture. It is important to note that, when flaying, the hide should be cut along the dead centre from the neck to the cod.

All cutting and scoring of hides through careless flaying should be prevented as much as possible. These cuts or scores very much depreciate the value of the hide, because the leather may have to be shaved down after tanning to a uniform thick-

ness to eliminate the scores. On this account it is better to flay the beast so as to leave a little meat on the hide, which may be removed afterwards, rather than run the risk of cutting the inner surface of the hide.

After the hide has been taken off, any adhesive pieces of meat and fat should be removed carefully as they cause an uneven surface and cure. These badly cured areas are also the first to suffer from insect damage.

If any blood or dirt adhere to the hide it should be washed off carefully. It is also advisable to trim the hides straight across the neck and trim off at knees and hocks.

2. **Methods of Curing—Hides and Skins.**—There should be no delay between the time of flaying the hides and their setting out for curing or drying. The sooner the better and the interval should not be longer than two hours.

Hides and skins may be "sun cured," "shade cured" or "dry salted." Sun and shade curing will be considered first. These methods have the advantage in that they do not require salt.

The report from the Imperial Institute indicates that there is very little to choose between the first two methods if they are properly carried out. The important point is to see that there is a free air circulation on both sides of the hide. If free air circulation is prevented, as when the hide is laid on the ground for instance, the hides dry out on the surface only which "bakes" hard and the escape of the moisture in the inside of the hide is prevented. The hides look perfectly dry and sound on the surface, but when tanned it will be found that the interior has putrified and the leather is practically worthless.

It is a common fault in curing to over-stretch hides. If they are stretched at all, they should not be stretched more than to prevent them from "crumpling" or losing their shape entirely.

(*a*) *Sun Cured.*—A modified "sun-cured" method was first recommended by the Imperial Institute and has given very good results in two trials in the Colony, one in dry and one in wet weather.

The hides are suspended from horizontal poles in lines running from east to west and a suitable distance from the ground. The tail, buttocks and hind shanks of the hide are tied to the poles, then other extremities being pegged to the ground. The pegs are placed in line with the shadow thrown by the poles at mid-day. At intervals of say, twice a year, the line of poles should be readjusted.

The hide is thus stretched at an angle with the ground, and fully exposed on both sides for drying. The rays of the sun fall obliquely on it and any rain runs off. Fig. 2 shows a number of hides stretched out to cure in this way. The time taken to cure hides by this method at Bulawayo was five days in a dry weather test and nine days in the rainy season. There was no difference between the quality of the hides of the dry and wet periods.

This method of curing is recommended for the Colony for farm use or by natives drying hides in the reserves. No shade is required in this method and the poles once set can be left and a number of hides can be cured at a time by the farmer or natives under supervision. The alternative method of "shade-curing" gives the same result, but probably requires the erection of a special shed if an open farm shed is not available.

(*b*) *Shade Cured.*—After flaying, the hides are taken and hung in the shade over a smooth round pole with a diameter of not less than 4 inches to prevent the hide being marked or cracked where it hangs over the pole. The hides must be turned daily for the first three or four days to prevent sweating along the line of the pole, which causes damage to the grain of the hide. Under local conditions this method of curing takes about eight days in dry weather and eleven days during the wet weather. Hides cured in this way are more prone to insect damage than the hide sun-cured method just described.

This method has been extensively used in Kenya for the drying of native hides, and Fig. 4 shows an illustration of the typical drying shed in use there.

There is no difficulty in the construction of these sheds. It is built with eaves about 6 feet off the ground with an open space all round. The hides are usually hung over smooth

poles, but it is sometimes recommended that they should be stretched on a rough square frame set up perpendicularly below the roof and spaced apart so as to allow for a free air circulation.

If only a few hides are handled it is not necessary to erect a shed for the purpose, and the small farmer can obtain quite satisfactory results by curing his hides over a pole in any shed. If the shed has a corrugated iron roof the poles should not be less than 3-4 feet below the roof.

(c) *Dry Salted.*—Hides and skins may be cured by "dry-salting." Dry salted hides keep better than hides cured without salt, and resist the attacks of insects better. As an off-set to this there is the cost of the salt. Some authorities hold that there is a stronger world demand for dried than for salted hides.

The hides or skins should first be evenly salted and then folded along the back, both sides meeting evenly and then left in this state for 48 hours in the case of skins and 60 hours for hides. About 10 lbs. salt is required for the average hide. After curing they should be left to dry in the shade or in a shed. They should not be stretched, pegged out or hung over a fence or bush, but should be hung over a pole in a shed or in the shade and turned daily until dry.

Drying by this method may take about nine days in the dry weather and about 14 days or longer in the wet weather. This is not a very satisfactory method in the wet weather as the moisture in the air is absorbed by the salt and the hides take some time to dry out properly.

3. **Common Defects, apart from Curing.**—(*a*) *Brands.*—The branding of stock is an evil, though in some cases a necessary one. When branding is practiced the brands should be confined to the least valuable parts of the hides and made as small as possible consistent with a legible mark. A letter size $2\frac{1}{2}$—3 inches is ample.

The most valuable part of the hide is the butt (hind quarter). This part should not be branded. Rather confine the brands to the cheek, neck or as low down on the thighs as possible.

(*b*) *Horn Marks.*—Horn damage is a frequent cause of depreciation. Under our present conditions it may take a long time to eliminate this source of loss. The remedy is to dehorn the cattle as calves or to use polled bulls.

4. **Disposal of Hides.**—In order to avoid insect damage or other deterioration, the hides should be sold as soon as possible. It is a criminal waste to allow them to lie about to deteriorte gradually or decay. If the hides have to be kept for any length of time they should be dipped into the cattle dip after curing. Care must be taken that they are not allowed to get wet after dipping. If they do get wet they should be hung out to dry properly or else they will putrify. The "arsenite" in the dip will act as a preventative against insect atttcks.

The hides or skins should be packed in comparatively small bales of 8-10 hides each, the whole bale weighing approximately 100-150lbs. The bales should be tied with rope not wire, which leaves rust marks, and full particulars of the consignor and consignee stencilled on a piece of sacking or hessian and this inserted under the rope. Paint or tar should not be used on the hides themselves. The hides should be folded only once down the spine with the hair inside. They should be folded just before they are quite dry to prevent the fold from cracking. Fig. 5 shows a well made up bundle of sundried hides. Wooled skins should also be folded once with the wool *outside,* but goat, Blackhead Persians and native sheep skins should not be folded.

Annual Report of The Division of Entomology,

FOR THE YEAR ENDED 31ST DECEMBER, 1935.

By RUPERT W. JACK, Chief Entonomoligst.

AGRICULTURE.

1. **Locusts.**—The extremely heavy invasion of the Red Locust (*Nomadacris septemfasciata*, Serv.) which the Colony sustained towards the end of 1934 did not result in an outbreak of hoppers of any serious magnitude. This was due to the ravages of parasites and disease amongst the invading swarms, the Locust Fungus (*Empusa grylli*) being by far the most potent factor in this connection.

In anticipation of an overwhelming hopper outbreak, very large supplies of pumps and poisons were purchased, but very little poison was used, and these large supplies still remain on hand.

The locusts which survived seem to have bred more successfully in Portuguese East Africa than in Southern Rhodesia, and in accordance with previous experience, some of the resulting swarms gradually infiltrated into this Colony, showing a marked prediliction for the comparatively humid eastern districts.

A limited number of swarms, some of great magnitude, has been present throughout the year, swarms being reported from time to time from all parts except the low veld. These swarms have been responsible for considerable damage to young grass, crops, plantations, etc., in various parts of the Colony, especially in the neighbourhood of the eastern border.

No conspicuous pre-breeding invasion from north of the Zambesi occurred up to the end of the year, and no egg-laying has been reported. Specimens examined up to the last day of the year showed ovaries not yet fully developed, although

the more advanced specimens were judged to be within about two weeks of oviposition at that time. Egg-laying is later this season than during any previous season of the present outbreak.

It is not anticipated that the hopper outbreak will be of serious magnitude, although there is as yet no indication of disease or parasites amongst the limited number of swarms in the Colony.

The absence of *Empusa* may be due to the fact that the early rains have been exceptionally light and the humidity well below normal. The same factor may have delayed egg development. The temperature on the other hand was above normal in November and about normal in December.

It is perhaps noteworthy that during the past year more reports of the attack of birds on locusts have been received than in previous outbreaks. The species of birds concerned include the White Stork (*Ciconia alba*), the White Bellied Stork (*Abdimia abdimii*), the Brown Kite (*Milvus aegyptius*) and possibly other hawks.

Poisoned Locusts and Birds.—In view of assertions in the Press and elsewhere concerning the wholesale poisoning of locust eating birds through consuming poisoned locust hoppers, some experiments bearing on this question were carried out with fowls in February and March in collaboration with the Division of Chemistry.

An account of these experiments were published in the *Rhodesia Agricultural Journal*, May, 1935 (D/A. Bull. No. 954).

Briefly, no indication was obtained of danger to bird life from a diet of poisoned locust hoppers, even when the latter were sprayed with poison at three times the prescribed strength.

2. **Pests of Stored Products.**—(*a*) *Tobacco.*—The practise of cleanliness and early and complete disposal of crops has again showed its value as a practicable measure against the Stored Tobacco Worm (*Ephestia elutella*, Hubn.) and the Tobacco Beetle (*Lasioderma serricorne*, Fab.). No pests of stored tobacco have been found during the year in any warehouse

where these hygienic methods have been followed, amounting to several hundred warehouses (see under Tobacco Pest Suppression Act, 1933, below). The tobacco beetle has been found in several warehouses, but in each case its presence has been shown to be due to accumulation of waste or the retention of a few bales of previous season's crops.

(*b*) *Maize*.—The most serious pest of stored maize in the Colony is the weevil, *Calandra oryzae*, L. A study of its bionomics has been commenced.

The same hygienic methods of control as practised for tobacco are followed as far as practicable, but fail to secure satisfactory results for four main reasons, *viz.*, (1) the large domestic consumption precludes complete disposal from farm storage sheds; (2) the domestic consumption, together with the nature of the export market, results in some of the co-operative storage sheds not being emptied until the new crops are almost ready for storage; (3) part of the crop is already infested when taken into the co-operative sheds. Infestation takes place in the field from store-rooms and sheds, and may be quite severe as an initial infestation when the crop is grown near a co-operative shed. Infestation may also occur when a new crop remains outside a shed which is still being emptied of the old crop. This condition obtained in at least one co-operative shed during the year, adult weevils being numerous on the outside of the bags containing the new crop; (4) the beetle is readily distributed from the towns to the country on bags of various foodstuffs, and probably in railway trucks.

3. **Pests of Growing Tobacco.**—(*a*) Root Gallworm (*Heterodera marioni*, Goodey).—This pest is one of the most serious affecting the crop, and is likely in the future to be a factor of the greatest importance to the industry. It is hoped that investigations on the dispersal of the nematode will be carried out next year, and particularly an enquiry into the possibility of spread by river water. Among the host plants of the nematode found during the year are the flower *Celosia trigyna*, the "Pig Weed" (*Amaranthus paniculatus*), and a hedge plant, Holmskioldio sp. (*Verbenaceae*), Velvet Beans (*Mucuna*, sp.) and Sunnhemp are highly resistant.

(*b*). Tobacco White Fly (*Fam. Aleyrodidae*)—The strict enforcement of the law concerning clearing of all tobacco plants from the fields during the dry season, has resulted in a decrease in the numbers and importance of the White Fly which is the vector of "Leaf Curl" disease. The inspector reports only a comparatively few cases of neglect in clearing up after the growing season.

(*c*). Sand Crickets (*Brachytrypes membranaceus*, Dr.)—This pest has increased greatly in certain districts during recent years, being particularly troublesome in sand-veld areas, newly transplanted tobacco being seriously damaged at night. Poison baits composed of cut-up greenstuff or maize meal steeped in arsenic solutions (1%, $2\frac{1}{2}$% and 5%) gave negative results. A moistened mixture of barium fluosilicate and maize meal in the proportions by weight of 1:25 and 1:50 gave promising results in a series of field tests. A small quantity (about half the size of one's thumb) is placed directly into the mouth of the main burrow, which is usually easily disclosed beneath a heap of excavated soil.

(*d*) *Other Pests of Tobacco.*—Wireworms (*Trachynatus spp.*, *Psammodes spp.*) have been reported near Salisbury as serious pests of the newly transplanted crop. Leaf-miner (*Phthorimaea operculella*, Zell.) did much damage in January-February in the Sinoia district.

4. **Pests of Citrus.**—The mild nature of the outbreak of the Cotton Bollworm (*Heliothis obsoleta*, F.) was the outstanding feature of the year at the Mazoe Citrus Estate. The unusually cold winter of 1935 may be partly responsible for this, and the end of the long dry spell of seven weeks from the end of January may have been a contributing factor. The Citrus Aphis (*A. tavaresi*, del G.) gave little trouble, but the outbreak of Citrus Thrips (*Scirtothrips aurantii*, Faure) was heavier than usual, possibly due to the dry spell, which has been mentioned previously. The Australian Fluted Scale (*Icerya purchasi*, Mask) was more prevalent than usual owing to the comparative freedom from natural enemies. The latter, however, became effective towards the end of the year. Red Locusts did no damage.

The above information was kindly supplied by the Manager of the Citrus Estate of the British South Africa Company at Mazoe.

5. **Pests of Fruit Other than Citrus.**—The white Mango Scale (*Aulacaspis cinnamoni*, Newst.) was found in December for the first time in the Salisbury district apparently having been carried from the Umtali districts on a young mango tree.

6. **Cotton Pests.**—The effects of American Bollworm (*H. obsoleta* F.) were, to a considerable extent, obscured, as a result of the drought following on the very wet weather experienced in the early part of the season. Many crops were badly affected, and in some cases the damage was very severe.

Sudan Bollworm (*Diparopsis castanea*, Hmp.) was not in evidence to any great extent through the country, but detailed investigation into the pest at Gatooma goes to show that it may develop into a very serious problem, if the evil practices of ratooning or 'stand over' cotton becomes general.

Cotton Stainer Bugs (*Dysercus spp.*).—Possibly as a result of drought, stainer damage was less than usual.

Jassid.—Attacks were not severe, but the strains of cotton generally grown now are such that only in a year of very severe jassid infestation would the effects be noticeable.

The above information was kindly supplied by Mr. G. S. Cameron, Cotton Specialist, Empire Cotton Growing Corporation.

7. **Pests of Growing Maize.**—The infestation by the Maize Stalk Borer (*Busseola fusca*, Full.) was unusually light, except in late grown fields.

"White Grubs," the larvae of the chafer beetle, *Eulepida mashona*, Arrow, have been found to be much more widely distributed than was supposed, and much damage to maize and vegetable crops has been reported from the Victoria, Enterprise and Salisbury districts.

Investigation were made into the outbreak of "Streak" disease reported in the early part of the year from the Umtali district. This disease is not at present considered to be identical with a virus disease in other parts of Africa where

it is transmitted by Jassids of the genus *Cicadulina*. A number of Jassids, two species of which have been identified as *Peregrinus maidis*, Ashm. and *Euscelis sp.*, was collected from infected plants, but negative results were obtained with them in transmission experiments at Salisbury. Further investigations are proceeding.

8. **Pests of Vegetable and Garden Plants.** Cutworms (*Euxoa segetum*, Schiff) were the most serious pests during cabbages, cauliflowers, etc., grown in vleis during the dry season. Poison baits composed of cut-up greenstuff steeped in a solution of sodium arsenite or Paris Green gave poor results. A mixture of Paris Green and maize meal in the proportion by weight of 1:50 gave promising results in heavily infested areas cleared of crops. The Diamond Black Moth (*Plutella maculipennis*, Curt), was a serious pest of cabbages in the late dry season near Salisbury. Bagrada Bug (*B. hilaris*) was reported from many districts damaging vegetable crops, especially crucifers. The "yellow thrips" mentioned as a pest of onions in the Eastern districts in my 1934 Annual Report, p. 7, has been identified as *Thrips tabaci*, Lind. The fruit fly, *Dacus ciliatus*, Lw., was a pest of marrows in the Salisbury district. In the Umtali district "*white grubs*," the larvae of a chafer beetle (*Melolonthidae*) is reported as a serious pest of pineapples (*Ananas*).

9. **Miscellaneous Insect Records.**—The following insects and their host plants are worthy of record. Most of the records are the result of observations made during the year, and a few others of earlier observation when no authentic names were available:—

(1). A blue butterfly (*Leptomaryna lara*, L.) the caterpillar of which damages succulents;

(2). The Bruchid, *B. chinensis*, L., which infests kaffir beans (*Vigna* spp.)

(3). The Bruchid, *B. impressithorax*, Pic., which infests the seeds of the Kffir Boom (Erythrina);

(4). The weevil, *Systates exaptus*, Mashl., which defoliates coffee in the Umtali district;

(5). The Scolytid Beetle, *Stephanoderes agnatus*, Egg., which infests the seed pods of Msasa (*B. randii*);

(6). The moth, *Orgyia venusta*, Hmp., (Lymantridae) of which the larvae defoliates geraniums (Pelargonium);

(7). The Scale Insect, *Akermes andersoni*, Newst., which was found on an orange tree in the Umtali district;

(8). The Tettigometrid-bug, *Hilda patruelis*, St., which injures the fruit and twigs of wild figs.

10. **Intercepted Pests.**—The Bruchid Beetles, *B. laticornis*, Boh. and *B. subroseus*, Mots., were found in the seeds of *Prosopis alba*, Griseb. (Leguminosae) imported from South America. The Bruchid, *B. analis*, F., were found in chick peas (*Cicer arietum*, L.), imported from South Europe.

MEDICAL AND VETERINARY.

Tsetse Fly.—The control established over the *mortisans* area in the northern districts of the Colony has continued effective during the year. No advances have been recorded and further definite retrogression has occured in areas where such retrogression falls within the programme.

The following is a summary of the results of the operations to date:—

1. The general advance of *morsitans* has been held up along the whole front with the possible exception of a short section in the west between the Shangani and Zambesi rivers, where operations have not been considered practicable due to the nature of the country.

2. At a conservative estimate over two thousand square miles of country have been approximately cleared of tsetse.

3. Trypanosomiasis due to *morsitans* hase been practically eradicated from the European farming areas.

N.B.—The last statement does not apply to certain farms in the Gwaai Settlement where fly has been present since the Settlement was started in 1929, as an anti-tsetse measure, but there is a clear prospect that it will shortly be possible to keep cattle on these farms.

The different sections of the "fly front" may be dealt with briefly as under:—

1. **Darwin.**—Operations were commenced in this district in 1930. As late as 1932 trypanosomiasis was prevalent amongst cattle from the Escarpment southwards to farms situated south of the Native Commissioner's Camp.

No cases have been recorded in this area during the past two years, and native cattle are gradually being moved northwards and reoccupying ground previously evacuated.

In 1932 the easternmost and most used of the main routes for northern natives entering the Colony, namely, the Masongerera foothpath, ran along the fringe of the fly area in the Zambesi Valley, the fly area extending westwards from the footpath. A deflying station at the top of the Escarpment accounted for exactly 100 tsetse flies during that year. With the retirement of the fly limit westwards in the course of the present operations, this route has become entirely free from fly and none at all have been taken at the deflying station during the past year. The number of southward bound natives who passed through the chamber during the year was 22,762. The clearing up of this path is of importance in reference to the possibility of northern natives being infected with sleeping sickness.

It is difficult to make a definite statement concerning the area cleared of fly in this district, for the reason that on the higher veld south of the Escarpment fly had not succeeded in establishing itself by 1930, when the operations were commenced. Only odd flies were to be met with irregularly at that time over an area of about 400 sq. miles or more. These were, no doubt, individuals carried up from the Zambesi Valley, but sufficient flies were involved to preclude the keeping of cattle over a considerable area, particularly in the Kandeya Reserve. The position is now that cattle are returning to this area, and so far no losses have been reported. It would seem, however, that danger must persist close to the Escarpment as long as the low veld is infested. In the low veld itself the fly has unquestionably receded to a short distance westward as above.

2. **Sipolilo.**—The portion of this district south of the Escarpment was seriously affected by a steadily advancing fly from 1923 to 1926, and many head of cattle died. As the result of the operations commenced in 1924, the whole of this section of the sub-district has been practically free from fly for over a year and there have been no cases of trypanosomiasis for several years. The area cleared of fly in this section is estimated at about 400 sq. miles.

3. **Lomagundi (Doma).**—The fly menace developed in this section at the same time as in the adjacent Sipolilo section. Fly has now been driven back about 20 miles to the north and no cases of trypanosomiasis have been recorded in the past two years, notwithstanding the fact that cattle are now running ten miles further north than any animals could be kept during the critcal period of the advance. The area cleared of fly in this section is estimated at fully 600 sq. miles.

4. **Urungwe.**—Operations were commenced in this section in 1930. The tendency of the fly to overrun this sub-district, which has been evident for a number of years past, has now apparently been arrested, but no general retrogression can be recorded, nor is it to be anticipated in view of the nature of the country in the definitely infested area. On the eastern side, near the Angwa River, which was invaded and brought within the zone of operations in 1930, the fly has been driven as far north as in the adjacent Doma section. No further developments concerning trypanosomiasis have been recorded in the Urungwe sub-district during the year.

The area cleared of fly in this section is estimated at about 100 sq. miles.

5. **Lomagundi S.W.**—Operations were commenced in this section in 1930, at which time a considerable number of cattle became infected with trypanosomiasis in the Gambuli Valley settlement.

The section is now almost free from fly, only odd specimens being taken occasionally on the lower portion of the Umfuli River. No cases of trypanosomiasis have occurred for several years. The area cleared of fly in this section is estimated at 300 sq. miles.

6. **Gatooma.**- This area includes, besides the fly infested portion of the Hartley district, the formerly infested area in the north of the Gwelo district, and a small portion of the Sebungwe district between the Mafungabusi Plateau and the Umniati River. Operations were commenced in 1927, when the position was very serious indeed and cattle were dying freely on the European farms north of Gatooma. No fly has been taken in the Gwelo district during the year nor south of the Mtanke River in the relevant portion of the Sebungwe district. In the Hartley district the whole of the formerly heavily infested fenced area is now nearly clear, but an odd fly is still occasionally seen near the western game fence. In the zone ten miles west of the western game fence brought within the zone of operations in September, 1932, the formerly high densities have now been greatly reduced, except in one circumscribed area near the Sakugwe River, close to the westernmost limit of the operations.

The occupied zone in the Hartley district has now been practically cleared of trypanosomiasis, two cases only having been recorded during the year on one farm associated with the Rob's Drift Road, which traverses the fly area as far west as the Umniati River. A great diminution in the number of flies caught at the deflying station on this road is now apparent.

The area approximately cleared of fly to date in the Hartley, Gwelo, and S.E. Sebungwe districts is estimated at about 600 sq. miles.

7. **Gwaai-Shangani Area.**—This area includes portions of three districts, namely, Wankie, Sebungwe and Bubi. Operations against extremely high fly densities were commenced in 1930. The fly is now definitely receding, as is shown not only by direct surveys but by the fact that, during the last five months of the year, no flies at all have been taken off traffic traversing the Bulawayo-Victoria Falls road. The total for the whole year, including flies taken off natives coming from the Shangani River, is very small. Comparative figures of the flies taken at deflying stations in this area show a great reduction, which has been progressive.

During the year the native hunters in the region of the Shangani Native Reserve were brought under control of the Division, twenty being placed on the pay roll. They are now under the direction of an assistant tsetse fly ranger. The threat of a further advance of fly up the Shangani River mentioned in last year's report has not materialised.

Owing to the fact that this area includes considerable tracts of gusu forest (*Baikiaea plurijuga*, *Copaifera coleosperma*, etc.) which seems to be avoided by the fly, it is not possible at present to indicate any extensive area cleared of fly. Fly appears now, however, to be evanescent in the valley and neighbourhood of the Gwaai River as far down as the Gwaai-Shangani junction.

TRAFFIC CONTROL.

Urungwe. (1) *Vuti Chamber.*—Three hundred and eighty-four (384) vehicles, two thousand nine hundred and five (2,905) pedestrians and one hundred and forty-seven (147) cyclists passed through the cleansing chamber, bringing a total of four hundred and fifty-four (454) flies (271 males, 183 females). Of this number 204 flies (127 males, 77 females) were caught off motor vehicles, and 250 flies (144 males, 106 females) off pedestrians and cyclists. The number of flies caught in 1932, 1933 and 1934 were 106, 94 and 178 flies respectively.

No operations against game are being carried out beyond this chamber, and the density of fly is probably increasing.

(2) *Manyangau Chamber.*—Three thousand four hundred and forty-one (3,441) pedestrians and ninety-six (96) cyclists passed through the chamber, bringing two hundred and ninety-six (296) flies, of which 194 were males and 102 females.

This station was established in January to deal with flies being carried along a footpath from the valley to "Pendennis Farm." It is obvious that it was genuinely required.

Gatooma.—*Rob's Drift Road.*—One hundred and fifty-two motor vehicles (152), three hundred and seventy-seven (377) pedestrians and four hundred and thirty-one (431) cyclists passed through the chamber, bringing a total of 36 flies (16

males and 20 females). Of this number 21 flies (9 males and 12 females) were taken off cars, and 15 flies (7 males, 8 females) off pedestrians and cyclists.

The numbers of flies caught in 1932, 1933 and 1934 were 377, 498 and 478 respectively. The great decrease in the number of flies caught at Rob's Drift Road during the past year is associated with a similar decrease in density of fly in the zone west of the fenced area, in which operations were commenced in September, 1932.

Bulawayo-Victoria Falls Road.—The great improvement previously mentioned is shown in detail by the following figures of flies taken at the chambers off motor and pedestrian traffic.

(1) *Dett Valley Chamber.*—Three hundred motor vehicles (300), nine hundred and eighty-five (985) pedestrians, and eighty-nine (89) cyclists passed through the chamber, bringing 5 flies (2 males, 3 females). Of this number, 1 fly (female) was taken off cars and 4 flies (2 males, 2 females) were taken off pedestrians and cyclists.

The numbers of flies caught at this chamber in 1932, 1933 and 1934 were 336, 183 and 59 flies respectively.

(2) *Farm 114 Chamber.*—Eight hundred and sixty-seven (867) motor vehicles, nine hundred and ten (910) pedestrians and thirty-six (36) cyclists passed through the chamber, bringing a total of 22 flies (12 males, 10 females) of which 2 flies (1 male, 1 female) were taken off cars and 20 flies (11 males, 9 females) off pedestrians and cyclists. The numbers of flies caught in 1932, 1933 and 1934 were 299, 152 and 104 respectively.

(3) *Walker's Road Chamber.*—Two (2) cars, one thousand five hundred and nine (1,509) pedestrians and fourteen (14) cyclists passed through the chamber bringing fifty-nine (59) flies. These flies (26 males, 33 females) were all taken off pedestrians and cyclists.

The numbers of flies caught at this chamber in 1932, 1933 and 1934 were 4,180, 989 and 551 respectively.

(4) *Sikumi Farm.*—One hundred and eight (108) motor vehicles, one thousand one hundred and eighty-six (1,186) pedestrians, ten (10) cyclists, and 105 donkeys passed through the chamber, bringing eight (8) flies (5 males, 3 females) all taken off pedestrians and cyclists.

The number of flies caught at this chamber in 1933 (seven months only) was 64, and in 1934 30 flies were caught.

Mabale Valley.—The following traffic was examined during the year:—

(*a*) *Out of the Area.*—Eight hundred and seventy-seven (877) pedestrians, and fifty (50) cyclists passed through the chamber, bringing 13 flies (7 males, 6 females). Of this number 5 flies (4 males, 1 female) were taken off cars, and 8 flies (3 males, 5 females) off pedestrians and cyclists.

(*b*) *Into the Area.*—Six hundred and nine (609) cars, two hundred and five (205) pedestsians, and twenty-nine (29) cyclists passed through the chamber bringing 5 flies (2 males, 3 females) all taken off pedestrians and cyclists.

The numbers of flies caught in this chamber in 1933 and 1934 were 154 and 196 flies respectively.

Total 18 flies (9 males, 9 females).

The great reduction in the number of flies taken at all stations in the Gwaai-Shangani area is associated with the successful progress of the operations in this region.

Darwin.—Two chambers deal with the pedestrian traffic crossing the Escarpment from the Zambesi Valley. The following traffic was examined during the year:—

(*a*) *Masongerera's Path Chamber.*—Twenty-two thousand six hundred and ninety-six (22,696) pedestrians and sixty-six (66) cyclists passed throagh this chamber. No flies were found. At this chamber in 1932, 1933 and 1934 the flies caught number 100, 12 and 9 respectively.

(*b*) *Nyamarapara Path Chamber.*—Four thousand three hundred and fifty-four (4,354) pedestrians and 12 cyclists passed through the chamber bringing 161 flies (124 males, 37 females). The numbers of flies caught at this chamber in 1932, 1933 and 1934 were 112, 97 and 85 respectively.

The fly limit below the Escarpment has receded a short distance to the east, clearing the much used Masongerera's path. This retrogression is associated with operations against game in the Chiswiti Reserve, which do not extend as far east as the Nyamarapara path.

Melsetter Border.—The anti-tsetse clearing along a portion of the Melsetter border was extended to thirty-five miles in length from 1932-1934. During 1935 only conservation work was carried out, including the broadening of the clearing along certain sections. The clearing was successfully burnt over in September and October.

The position concerning trypanosomiasis on the farms, which the clearing was designed to protect, has remained very much more satisfactory than before the clearing was created, but some cases occurred on several farms during the first part of the year. In view of the situation of certain of these farms in relation to other farms on which cattle have been running, it is very difficult to explain all the cases on the basis of their being due to fly which had crossed the clearing, and further developments need to be awaited as a guide to further action.

The species of tsetse involved in this locality is *G. pallidipes,* and possibly also *G. brevipalpis. G. morsitans* is not known to occur close to our border in this region.

Enquiry into Conduct and Effect of the Anti-Tsetse Operations.—The destruction of game involved in the operations against *morsitans* had been the subject of agitation in certain quarters for a considerable time previous to the meeting of Parliament in 1935. During this session a strong attack was launched on the Government policy in this connection. The efficacy of the operations was called into question and their conduct criticised.

Following the debate I addressed a minute to the Secretary stating that I would welcome an impartial enquiry into the conduct and effect of the operations.

In the final event the recently formed Trypanosomiasis Committee, which is representative of all the sciences having a bearing on the problem, was asked to conduct the enquiry.

Interested persons throughout the Colony, and even in England, were accordingly invited to submit their views and the whole of the evidence thus accumulated was collated and submitted to the Committee. Although a member of the Committee I took no part in the matter beyond collecting and submitting evidence, and the final finding was drawn up by a special sub-committee, of which I was not a member.

A copy of this resolution is attached to this report.

Tsetse Fly Research.—The success of the operations against *morsitans* based on reduction and control of game does not alter the fact that large scale destruction of wild animals is essentially repugnant.

For many years past I have endeavoured to obtain funds for research with a view to finding a feasible and less objectionable alternative to game destruction. Such schemes have been based upon the establishment of a field research station and have not materialised on account of the relatively heavy expenditure involved.

Finally, during the year under review, I suggested that decision concerning the question of a field research station might be deferred pending the prosecution of laboratory research into the physiology and behaviour of tsetse flies, which could conveniently be carried out at Salisbury at an expenditure of not more than a few hundred pounds per annum.

Somewhat similar work to that projected has recently been carried out with *Glossina tachinoides* and *G. submorsitans* in Nigeria by Buxton and Lewis, and, I understand, is in progress with *G. palpalis* in Uganda (Mellanby), and with various species of *Glossina* in Tanganyika (Potts). The aim in general is to study the reaction of the flies and their pupae to various environmental factors.

Provision was made for the undertaking in September, and a start has been made with such apparatus as has been available or could readily be produced, but at the end of the year we are still awaiting the arrival of the major portion of the necessary apparatus from England.

The carrying out of this work in Salisbury has many advantages compared with work in an actual fly area, namely, in respect to the utilisation of existing accommodation, the availability of cheap and reliable electric current, the proximity of officers of other technical divisions, whose assistance will be invaluable, and the fact that bovines can be used for feeding the flies, which may be an advantage.

On the other hand, as Salisbury lies well outside the climatic range of the fly, it has been considered necessary to provide accommodation for the main stock of flies, in which temperature and humidity can be controlled within reasonable limits. In this connection I have pleasure in expressing appreciation of the collaboration of the Department of Public Works in producing to my specification a well constructed insulated cabinet made of Burmah teak and glass at a very reasonable price.

I have also gratefully to acknowledge most useful advice received in reference to this undertaking from various sources in Great Britain, particularly The Imperial Institute of Entomology, Dr. P. A. Buxton, of the London School of Hygiene and Tropical Medicine, and Dr. M. C. Marsh, of the Wool Industries Research Association, Leeds.

Screw-worm (*Chrysomyia bezziana*, Vill.).—The infestation by screw-worm of sores caused by cattle rubbing the places where small blood sucking flies (*Lyperosia minuta*, Bez.) attack them, has been reported from the Umtali district.

Tick Survey.—The Bont Tick (*Amblyomma hebraeum*, Koch), the vector of heartwater, is now known to have spread to widely separated localities in Matabeleland, being particularly abundant in the Chibi, Insiza, Bulalima Mangwe and Wankie districts. The usual dipping has had to be supplemented by hand dressing.

Suspected Poisoning of Cattle due to Insects.—A large number of Pentatomid bugs identified as *Agonoscelis erosa*, Westw. was removed from the rumen and abomasum of cattle in the Gwelo district. It is possible that the copious excretions from these insects may have been toxic to the animals. The bugs

have the habit of clustering on shrubs and herbage, and it is probable that the cattle accidentally ingested them in course of feeding.

Conference of Technical Officers representing Northern Rhodesia, Nyasaland and Southern Rhodesia.—A conference as above was held at Salisbury during the week commencing December 16th and on the 18th I attended a meeting dealing with *Trypanosomiasis*.

The discussion covered both human and animal trypanosomiasis and also the entomological aspects of tsetse fly control. An important resolution was passed to the effect that the Southern Rhodesian Trypanosomiasis Committee should be extended and should include within its activities the three States represented at the Conference.

The meeting undoubtedly served a very useful purpose, but the presence of entomological delegates from the other States would have added interest to the discussion.

Scientific Visits.—The Colony was visited by Mr. C. G. M. Swynnerton, Director of Tsetse Research, Tanganyika, during August and September.

Mr. Swynnerton accompanied me to the scene of the tsetse fly operations at Lomagundi (Doma), Gatooma and Melsetter. Our thorough discussion of the various aspects of the tsetse fly problem was most interesting and helpful.

Mr. Swynnerton, by special request, addressed a meeting of the Trypanosomiasis Committee on August 27th and particularly urged consideration of the feasibility of combining tsetse fly control with afforestation. Incidentally he expressed himself as favourably impressed by what he had seen of the effect of the operations against *morsitans* in this Colony.

Dr. W. A. Lamborn, Medical Entomologist, Nyasaland, also passed through Salisbury in August on his way to and from Bechuanaland, but was unable to spare the time on either occasion to visit the fly area.

Publications.—

1 "*The Control of Tsetse Fly in Southern Rhodesia,*" by R. W. Jack.
Rhodesia Agricultural Journal, XXXII., 4, pp. 237-261. (Reprinted as Bull. 950).

2. "*Biological Notes on some Diptera in Southern Rhodesia*," by A. Cuthbertson, *Occasional Papers of the Rhodesian Museum*, Bulawayo, No. 4, pp. 11-18. (Illustrated.)

3. "*Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts*," by J. K. Chorley and R. McChlery.

   Rhodesia Agricultural Journal, XXXII., 5, pp. 322-326. (Reprinted as Bull. 954.)

4. "*Report of the Chief Entomologist for Year ended 31st December*, 1934," by R. W. Jack, Ibid pp. 558-581. (Reprinted as Bull. 862.)

5. "*Entomological Hygiene on the Land. The Importance of Clean Methods of Cultivation*," by R. W. Jack.

   The Rhodesia Herald, August 21, p. 21. (Agricultural Show Issue.)

The Insect Collection.—The following numbers of insect species were identified by the Museums and Institutions named. The British Museum (Natural History), 15; The Imperial Institute of Entomology, London, 75; The University Museum, Oxford, 21; Zoologische Sammlung, Munich, Germany, 27; The American Museum of Natural History, New York, 18; other U.S. Museums and Institutions, 7; The South African Museum, Cape Town, 30; other South African Museums and Institutions, 12; The Rhodesian Museum, Bulawayo, 28. More than 350 species of insects have been sent overseas for identification.

A large number of specimens, including the types of species new to science, have been presented to the British Museum (Nat. History), the University Museum, Oxford, the Rhodesian Museum, the American Museum of Natural History, and Harvard University, U.S.A.

The correct identification of insects of economic importance is, of course, essential to the progress of our work, and in this connection I must gratefully acknowledge the service received from the Imperial Institute of Entomology in London.

AMDINISTRATIVE.

Tobacco Pest Suppression Act, 1933.—The Act continues to work smoothly. Under Part I. inspectors discovered the presence of the Tobacco Beetle, *Lasioderma serricorne*, Fab. in several premises, and the Stored Tobacco Worm in none. Infestation by the Tobacco Beetle was traced, in every infested country premises, to the retention of a bale or so of old tobacco, mostly that of 1933-34 season's crop, *i.e.*, previous season's crop. These bales were all burned. Infestations in two town grading and exporting warehouses were confined to tobacco scrap accumulated underneath wooden floors. The licences of the owners of these warehouses were temporarily suspended, and the suspension was not withdrawn until the warehouses had been properly cleaned, and all refuse burned.

Under Part II. of the Act ten premises were brought by an inspector to the notice of the police on account of the presence, after 1st August, of growing tobacco plants. Subsequent inspection showed that these farms had been cleaned. Because of the lateness of the fire-cured crop, certain farmers were granted an extension of the time before which growing plants were to be removed.

Number of Licences granted and Inspections made during the year under review and the previous year.

	1935.	1934.
Licences	586	649
Inspections	633	683

Importation of Plant Regulation Ordinance, 1904.

Number of Consignments of Plants, Fruit, etc., dealt with by the Plant Inspectors at the various Ports of Entry.

	1935.	1934.
Salisbury	2,719	2,741
Bulawayo	11,922	9,331
Umtali...	765	644
Gwelo	882	833
Plumtree	721	673
Beitbridge	7	—
	17,016	14,222

Number of Permits for the introduction of Plants into the Colony.

	1935.	1934
Special permits	143	163
Annual permits	60	66

Regulations in other Countries affecting Export of Plants from Southern Rhodesia.

Number of Certificates of Cleanliness issued in respect of Plants, etc., intended for export to other countries.

	1935.	1934.
Certificates	58	81

More certificates were issued in respect of potatoes destined for neighbouring countries than for any other class of plant or plant product.

Injurious Substances and Animals Ordinance, 1909.

Number of Permits issued for the Importation of Beeswax and Foundation Comb from Overseas.

	1935.	1934.
Foundation Comb	1	2
Beeswax...	1	1

It should be noted that the above permits are in respect of importation from overseas only. Beeswax and foundation comb accepted into the Union of South Africa may be imported from that country without further permit.

Nurseries Ordinance, 1909.—One nursery was obliged to remain in quarantine on account of Red Scale, *Chrysomphalus aurantii*, Mask.

Number of Nurseries Registered and Inspected.

	1935.	1934.
Registered nurseries	18	19
Inspections	19	19

GENERAL.

Farms Visited.—One hundred and ten farms were visited and advice given on insect pest control, besides the six hundred and thirty-two inspections made under the Tobacco Pest Suppression Act, 1933.

Lectures.—One lecture to the B.S.A. Police on ticks and one lecture to the general public on tsetse flies were given by members of the staff.

Conferences.—Mr. J. K. Chorley attended the fourth Imperial Entomological Conference held in London from 19th to 27th September, 1935.

The Executive Committee of the Trypanosomiasis Committee has carefully examined the evidence submitted to it concerning the afficacy or otherwise of the measures at present adopted by the Chief Entomologist for the control of the tsetse fly in Southern Rhodesia, and has come to the following conclusions:—

1. That a majority of those submitting evidence is in favour of the measures adopted and of their continuance. Many of those averse to the slaughter of game admit that under local conditions it may be necessary.

2. The Committee considers it necessary to point out that the present system of fencing and game destruction is an emergency measure which has been evolved as the result of experience and expediency in order to protect some 30,000 square miles of this territory from invasion by the tsetse fly and the diseases of man and animals transmitted by it.

3. It has been estimated from reliable information and records that in the pre-rinderpest days half the total area of Southern Rhodesia was infested by the tsetse fly. After the epizootic of 1896 the fly disappeared from all but a few limited areas and now occupies some 20,000 square miles of the northern parts of the Colony. There is every reason to fear that unless arrested it may re-invade the whole of its old habitat.

4. The southern limit of the present invasion constitutes a "front" of no less than 600 miles. The severity and the enormity of the problem, therefore, will be appreciated.

5. The fact that the local tsetse fly (*G. morsitans*) can infect man with an acute form of "sleeping sickness" adds to the danger of the situation.

6. It is open to question whether the area at present occupied by the fly is worth reclaiming, but it is the agricultural land on the edge of the fly belt and the enormous area to the south of the present infested area, much of which is of great agricultural and mineral value, which chiefly concerns the Committee. The Committee has had to decide whether in order to save this area and the settlers already occupying it, the present measures adopted by the entomologists are justified.

7. Every member of the Committee is strongly averse to any unnecessary slaughter of wild animals. But in the history of Africa it has often happened that in the interest of civilisation it has had to be determined whether man or the wild animals should survive. The present position with regard to trypanosomiasis in this country presents a similar problem. It has to be decided whether man or the animals shall be sacrificed. Reluctantly, but after careful and conscientious consideration, the Committee has been compelled to the conclusion that in the interests of civilisation the animals must be sacrificed. It feels that in the circumstances the measures adopted by the Entomologist were and are justified and should continue.

8. The history of the manner in which the present measures came to be adopted should be more generally known and appreciated. When in 1918 the advance of the fly became apparent, measures had to be adopted to arrest it. The well-known association between the fly and the game suggested the driving back of the game as a method of repelling the fly. This was attempted in the Gwaai area and was successful so long as it was vigorously carried out. But, when discontinued, the game tended to return, bringing the fly with it. Something in addition to temporary shooting was obviously necessary in order to render the results permanent.

9. At a Conference held in 1925 it was decided to fence certain areas in the Lomagundi area and to drive out game between the fences, with a view to arresting the spread of the fly to valuable country south of the already infested area. The success attending this experiment led to the fencing of other

areas similarly threatened. But the application of these measures to the whole fly "front" of approximately 600 miles was a financial impossibility. The alternative was the driving back of the game without fencing as in the Gwaai area.

10. The Committee feels that the slaughter of game was as abhorrent to the entomologist as to others, but that, in the light of the knowledge available, there was no alternative method which would offer the prospect of success. The Chief Entomologist would have failed in his duty had he refrained from recommending the adoption of the method; and, the principle having been approved by Government, he was compelled to adopt it.

11. From the evidence put forward by the Chief Entomologist, which is adequately supported by statements made to the Committee in writing by farmers living on the edge of the fly areas, it cannot be disputed that the operations carried out against the game have resulted in the fly being held in check and in many cases being pushed back from areas into which it was encroaching. The operations appear to have been exceptionally successful in the Lomagundi district, and there is no doubt that farms upon which the fly had encroached have now definitely been cleared and are once again suitable for carrying cattle without fear of losses from trypanosomiasis. Although operations against the game have been carried out in the Gatooma area for seven years, the position here is not as satisfactory as in the Lomagundi area. From the evidence put forward by Mr. Machell it appears that the operations against the game have considerably improved the position in regard to trypanosomiasis on the Rhodesia Plantation Estate. On Woodstock and Milverton several cases of trypanosomiasis have occurred during the past year, although the Entomologist reports that no fly have been found around these farms for some considerable time. The Chief Entomologist has expressed the opinion that the outbreak on these farms may be entirely due to fly being carried through the protected areas by traffic. Although this is a feasible explanation, the Committee feels that this happening should be further investigated, with the object of ascertaining definitely that no residual foci of tsetse exist on the occupied side of the game fence. The Committee is of opinion that for the present measures to be

effective in preventing infection of stock on farms in the vicinity of a fly area, every effort must be made to overcome the ever-present danger of flies being carried out of a fly area by vehicles, natives and animals other than game. The present system of cleansing chambers, while greatly assisting in preventing the conveyance of flies by cars, is not sufficient to overcome the dangers associated with natives who come from a fly area, and steps should be taken to reduce this danger. Owing to the fact that definite beneficial results in checking the spread of fly have been obtained from the game destruction policy and that the hypothetical alternatives put forward in the evidence submitted are, in the opinion of the Committee, impracticable for one reason or another, the Committee is not prepared to recommend that the present operations against the game should be curtailed in any way at present. It is desired to emphasise that the present operations against game are carried out merely in a marginal belt on the edge of the fly area, and any losses caused by these operations are more than made good by the reproduction of the game in the protected areas. After careful consideration, the Committee cannot subscribe to the so oft expressed view that the shooting operation is gradually depleting the country of the natural fauna. The rate at which game may normally increase is exemplified by the present game population of the country, as compared with the period shortly following the rinderpest epizootic. Except from an aethetic point of view, therefore, there can be no more objection to the slaughtering of game in these marginal belts than to the destruction of the natural flora of the country, to make room for agricultural development.

12. The Chief Entomologist was fully aware to the distasteful nature of the task to which he was committed and repeatedly during many years pointed out the need for further research into the bionomics of the tsetse fly under local conditions. He pointed out that "the tsetse fly is delicately poised in the balance of nature," and undoubtedly hoped that by a more exact knowledge of the habits of the fly this balance might be upset. But although the Entomologist's representations received sympathetic hearing, no research station of the nature required by him was provided.

13. As to whether the present operations are carried out in the most economical manner, this Committee is unable to express any opinion, although it would appear from the evidence before it that officers from other Departments appointed by the Government to investigate the procedure adopted were completely satisfied, as they failed to suggest any manner in which the present procedure could be improved. The Committee considers that the Entomologist has made the best of a very difficult situation. The evidence indicates that, as far as possible, the work has been carried out efficiently and economically. The fact that an average of 2½ cartridges has accounted for one head of game indicates that very little careless shooting has taken place.

14. When the total cost of establishing the agricultural and mining industries of this country is considered, and the yearly expenditure on medical and veterinary health is taken into consideration, the expenditure of £5,000-£7,000 a year in order to protect man and animals in one-fifth of the territory from diseases deadly to them, cannot be considered excessive.

15. In the opinion of the Committee, the present system of organised and carefully controlled slaughter of game, as and when necessary, together with adequate fencing and the necessary control of traffic, should continue until an effective alternative is forthcoming.

16. The Committee is of opinion, however, that, in view of a condition of approximate equilibrium having been established, the next step is emphatically the provision of funds for the continuance of research into this important problem. The Committee fully realises that much money has been expended elsewhere in such research and that, to date, no method of dealing effectively with *Glossina morsitans* on a really large scale and in all classes of country has been discovered. At the same time, it is obvious that research alone can provide a reliable alternative to the present operations and it becomes a question of either providing funds for such research in this country or of continuing the present policy indefinitely, at least until such time as research being conducted elsewhere might conceivably furnish an alternative remedy. In this connection the Committee would, however, point out that measures dependent upon extensive tracts of

fertile country and a large native population, such as have been utilised to a limited extent in Tanganyika and elsewhere, are not generally applicable in this Colony and that measures which do not call for these exceptional conditions must be sought. Climate and general environment have so much influence on the life economy and behaviour of the tsetse fly that each country needs to study the problem from its own standpoint. A measure which might be both effective and practicable in Tanganyika would not necessarily be either in Southern Rhodesia.

17. To hasten the discovery of alternative methods the Committee would urge the Government to make adequate provision for research into the bionomics of the fly and the diseases transmitted by it. It considers that such research should not be limited to entomology, but that every scientific aspect of the problem should be studied. The Committee, however, feels that, if a research station is set up, the research officers should be freed from all routine duties, in order that they may be able to devote the whole of their attention to the problem being investigated.

18. The therapeutic study of trypanosomiasis has made remarkable progress during the last ten years, and it would appear possible to maintain cattle in fairly good condition even in a fly area, provided a suitable system of animal husbandry can be practised. This aspect of the problem is at present being investigated in this country, and, if the present indications are correct, there appears to be no reason why in the near future small native communities with their livestock should not be established in the most suitable parts of the present fly area, provided each community was regularly supervised and the animals treated. If this could be done and gradually expanded in conjunction with other measures, there is no doubt that this would go a long way towards meeting the existing chief criticism of the present control methods, *i.e.*, lack of permanence. Before such a plan could be put into force, however, further research on a fairly large scale would be necessary to ascertain precisely what measures would be essential to secure the desired results. The Committee suggests that the provision of funds, not only to ensure the continuation of research into this aspect of the problem, but

also to augment the work now being done, and to include large scale experiments with domestic stock both on the edge of and in the fly areas, would be of great value to the country.

19. The Committee wishes to emphasise the fact that Southern Rhodesia is in a particularly favoured position to conduct research work on *Glossina morsitans*. In all African Colonies where the fly problem is serious several species of fly exist and *morsitans* has so far proved to be the greatest problem. As this is the only species which occurs in the fly area under discussion and it appears possible to stop further spread so long as the present measures are maintained, any research work undertaken in this country can be planned purely on research lines without any of the complications made necessary in other Colonies by the fact that practical results are the primary concern of the investigators. In fact, it is probably true that in no other part of Africa are the necessary conditions for research into tsetse fly and trypanosomiasis so clearly defined as in Southern Rhodesia. In no other case is the early history of the fly distribution so well established. The centres where the fly persisted through the rinderpest epidemic are known with considerable accuracy and would undoubtedly throw very valuable light on the whole problem if thoroughly investigated. Many of the dry season retreats of the fly are known with certainty, as are also the most favoured breeding places. The various species of trypanosomes have been determined with accuracy and the response of the various strains to chemo-therapy has been carefully investigated for many years. It can thus be seen that the research work conducted in this country would have special importance to all the Colonies where *morsitans* occurs, particularly Northern Rhodesia and Nyasaland, and that investigations conducted here could be applied usefully to adjoining territories or other parts of Africa. The Committee feels that while the administration of trypanosomiasis and the operations for the control of tsetse fly must be continued as at present by the Departments concerned, there should be greater collaboration on research, which should no longer be carried out as if in

water-tight compartments. It considers it desirable that the research now carried out departmentally should be correlated, and it is suggested that the existing Trypanosomiasis Bureau might serve a useful purpose in this direction. The Committee also suggests that such co-operation might be extended to include neighbouring territories where similar problems exist, and that eventually the Tsetse Fly Committee of the Economic Advisory Council might be approached with a view to obtaining financial assistance from the Colonial Development Fund.

20. It may be pointed out that this Committee has not considered the position on our Eastern border, as in that part of the country a different species of tsetse fly, *viz.*, *G. pallidipes*, occurs and the operations under discussion do not apply to that area.

SOUTHERN RHODESIA.

Locust Invasion, 1932-36.

Monthly Report No. 40, March, 1936.

The only species of locust recorded in the Colony during the month has been the Red Locust (*Nomadacris septemfasciata*, Serv.).

No winged swarms have been reported since the 2nd. On that date a very large swarm harassed by great numbers of "locust birds," probably storks, was observed near Que Que, in the Gwelo district.

Hoppers have appeared on a greater or lesser scale in the districts of Darwin, Hartley, Lomagundi, Mazoe, Chibi, Makone and Salisbury. These have been, or are being, effectively destroyed.

Experiments with a poisoned bait evolved in the Union of South Africa and consisting of 1 lb. arsenite of soda (80%), 7 lbs. molasses and 92 lbs. of maize meal have given encouraging results against first and second stage hoppers, even under decidedly humid conditions. This bait should prove of particular value in cases where hoppers have hatched amongst growing crops.

Stomatorhina lunata, F., has been recorded attacking the eggs in one district. Otherwise there is no record of parasites or disease.

The weather throughout the month has been about normal in regard to mean temperature, but with a slightly abnormal range. Humidity and rainfall have been above normal.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

FEBRUARY, 1936.

AFRICAN COAST FEVER.

Disease was diagnosed on the farms Gwebi Wood in the Salisbury Native District; Umboe and Zebra Vlei farms in the Lomagundi Native District, and on New Park in the Matobo Native District.

MALLEIN TEST.

Fifteen horses, 12 mules and 14 donkeys were tested upon entry. No reaction.

IMPORTATIONS.

From Union of South Africa.—15 horses, 12 mules, 1 pig, 1,469 sheep.

From Bechuanaland Protectorate.—170 sheep, 40 goats, 17 donkeys.

From United Kingdom.—1 bull.

EXPORTATIONS.

To Union of South Africa —24 cows.

To Northern Rhodesia. 60 sheep.

EXPORTATIONS—MISCELLANEOUS.

To United Kingdom in Cold Storage. Chilled beef quarters, 1,850; frozen boned beef quarters, 2,358; frozen beef quarters, 4,925; kidneys, 4,379 lbs.; tongues, 7,945 lbs.; livers. 16,867 lbs.; hearts, 9,127 lbs.; tails, 3,300 lbs.; skirts, 3.925 lbs.; shanks, 11,115 lbs.

Meat Products.—From Liebig's Factory: Corned beef, 21,600 lbs. From the Rhodesian Export & Cold Storage Co., Ltd.: Bacon, 31 lbs.; dripping, 140 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

MARCH, 1936.

Pressure. The mean pressure for the month was uniformly slightly low.

Temperature. Mean monthly temperatures were slightly below normal.

Rainfall.- The good rains of February continued into March and slackened off towards the middle of the month and a further burst occurred at the end of the month bringing the total to 6.9 inches about 2.4 inches above normal. The total seasonal rainfall up to the end of March is 24.8 inches, about 2.6 inches below normal.

MARCH, 1936.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	89	59	81.4	65.7	73.5	75.1	72.0	68.0	82	66	...	2.60	4.98	12	...
Beitbridge...	964.2	...	97	54	85.4	67.5	76.4	...	74.5	67.9	71	65	4.8	2 10	1.61	5	1,500
Bindura...	890.7	...	83	58	78.9	64.2	71.6	...	69.5	65.5	81	64	6.4	6.44	5.35	17	3,700
Bulawayo	868.0	868.3	82	53	75.4	58.7	67.0	69.0	65.4	61.5	80	59	7.7	7.21	3.39	13	4,426
Chipinga	892.3	...	83	53	73.9	60.4	67.1	...	66.7	63.9	86	64	7.3	9.12	8.51	21	3,685
Enkeldoorn...	857.3	...	83	50	75.3	58.9	67.1	68.7	64.9	61.5	82	60	7.3	6.06	3.75	14	4,788
Fort Victoria	895.1	895.4	88	55	77.4	61.7	69.6	69.0	67 7	63.9	82	62	6.5	5.73	3 68	11	3,571
Gwaai Siding	903.1	...	94	54	82.5	63.8	73.2	...	69.2	65.0	80	63	5.8	6.58	3.66	19	3,278
Gwanda...	905.9	...	87	57	77.4	62.7	70.0	...	67.6	64.0	83	62	7.2	5.21	2.04	14	3,233
Gwelo	861.9	...	82	53	75.5	59.7	67.6	69.6	65.1	61.9	84	60	7.8	5.60	3.34	16	4,629
Hartley...	884.7	...	84	54	79.1	61.9	70.5	71 8	68.4	64.8	82	62	5.1	6.60	4.29	19	3,879
Inyanga...	836.4	...	81	49	74.0	56.3	65.2	...	66.1	60.9	74	58	5.3	6 47	5.91	15	5,503
Marandellas	837.2	...	79	53	73.8	57.7	65.7	...	63.6	60.7	85	59	7.3	10.15	5.84	17	5,453
Miami	877.9	...	81	58	76.6	63.1	69.9	...	66.9	65.0	91	64	9.0	6.84	5.49	20	4,090
Mount Darwin ...	906.8	...	84	57	80 3	64.0	72.1	..	70.2	66.8	84	65	7.0	6.33	3.73	12	3,179
Mount Nuza	801.4	...	69	41	61 7	51 4	56.6	...	56.3	55.8	97	56	8.8	18.92	...	28	6,668
Mtoko	876.6	...	...	55	...	62.4	...	...	69.6	65.1	79	63	4.9	2.38	3.54	11	4,141
New Year's Gift. .	...	...	90	56	80.7	62.9	71.8	...	70.2	66.1	80	64	...	3.27	4.31	14	2,690
Nuanetsi	961.8	...	90	55	83.2	65 5	74.4	...	72.5	69.3	85	68	4.9	4.06	2.77	10	1,581
Plumtree	863.8	...	86	53	76.4	59.8	68.1	...	66.5	61.5	75	58	6.2	6.88	2.82	14	4,549
Que Que	881.2	...	84	53	79.3	61.4	70.3	...	67.6	63.9	82	62	7.1	11.96	3.89	15	3,999
Rusape	861.8	...	84	55	75.8	60.0	67.9	...	64.9	62.3	87	61	6.9	4.76	5.60	14	4,648
Salisbury	854.1	854.4	83	54	77.2	59.9	68.6	68.6	67.0	62.8	79	60	7.1	6.06	4.53	21	4,885
Shabani...	909.9	...	87	55	78.6	63.5	71.0	...	69.9	65.7	80	64	7.0	4.02	4.93	9	3,131
Sinoia	887.5	...	85	56	80.8	62.8	71.8	...	70.0	65 7	80	64	5.3	6.94	4.12	15	3,795
Sipolilo	884.3	...	83	56	78.3	62.5	70.4	...	69.7	64.9	77	63	7.0	3.71	4.32	16	3,876
Stapleford	841.9	...	77	46	68.3	55.2	61.8	...	61.2	60.1	94	59	7.5	14.77	12.14	26	5,304
Umtali...	892.4	892.7	88	55	79.2	61.3	70.2	70.6	68.1	65.2	86	63	7.3	4.58	5.33	19	3,672
Victoria Falls... ...	...	...	...	...	...	...	...	...	...	..	...	...	..	12.86	3.17	21	3,009
Wankie	925.6	...	90	65	83.5	68.7	76.1	...	73.0	69.0	82	66	8.1	7 36	2.91	17	2,567

Rainfall in March, 1936, in Hundredths of an Inch. Telegraphic Reports.

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
1	11	6	42	21	7	21	...	...	1	10	69	132	28	...	...	...	3	...	...	...	...	...	...	1	11	...	...	...	66	66	9	504
2	147	16	13	19	...	6	1	...	...	...	84	25	2	...	...	...	2	...	18	9	...	...	5	26	58	6	...	...	15	158	4	614
3	65	21	17	7	1	1	1	2	...	...	7	4	32	7	12	6	44	...	154	9	...	...	26	60	35	8	...	...	43	143	5	710
4	56	63	84	54	25	39	17	15	3	6	87	150	3	...	...	...	3	...	1	8	...	...	...	4	12	...	...	...	50	87	19	786
5	21	29	48	36	123	26	57	5	21	5	41	30	39	25	116	77	18	1	7	...	...	...	...	...	...	...	...	23	79	58	18	903
6	96	24	180	59	122	92	81	59	4	1	19	45	4	38	1	11	34	4	...	3	...	...	...	...	1	...	...	..	24	34	23	959
7	64	36	102	16	44	20	42	47	4	6	1	13	10	19	5	16	18	1	8	6	..	...	4	9	6	5	...	...	31	74	16	623
8	14	52	52	13	33	44	80	36	...	3	5	16	7	5	52	49	16	3	23	39	6	3	1	12	3	...	3	...	32	12	109	723
9	1	14	26	9	5	43	94	5	5	16	7	33	13	12	118	7	1	2	16	21	3	...	4	12	28	...	...	...	1	7	40	543
0	7	10	32	12	...	30	79	1	...	...	11	61	4	16	...	...	...	...	...	5	...	2	...	...	..	...	...	...	1	17	147	435
Mean	49	24	63	28	45	33	44	16	5	6	41	59	16	13	37	18	11	1	9	7	1	..	2	7	15	1	...	4	39	64	27	685

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 429. Propagation of Kudzu Vine, by H. C. Arnold.

No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

No. 568. The Treatment of Arable Lands, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.

No. 598. Drought-resistant and Early Maturing Crops for Areas of Late Rainfall, by C. Mainwaring.

No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

No. 634. Barley, by P. V. Samuels.

No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

No. 650 Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.

No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

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No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pests Remedies Ordinance" during the year 1927-28.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwtring, Agriculturist.

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 762.—The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768 The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric. (Wye).

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No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.

No. 899. The Black Maize Beetle (Heteronchus Licus Klug), by C. B. Symes.

No. 904. Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932-1933. Part I.: Control of Locusts, by R. W. Jack, Chief Entomologist. Part II.: Biological Notes on the Red Locust, *Nomadacris septemfasciata*, Serv., by M. C. Mossop, A.F.C., M.Sc., Entomologist.

No. 906. The Locust Invasion of Southern Rhodesia, 1932-33, by R. W. Jack, Chief Entomologist.

No. 911. Screw Worm: A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Forword by R. W. Jack, Chief Entomologist.

No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.

No. 915. Tsetse Fly and Game, by R. W. Jack, Chief Entomologist.

No. 917. The Life History of the Screw-worm Fly, by Alexander Cuthbertson, Entomologist.

No. 934. Mycological Notes. Seasonal Notes on Tobacco Diseases. 7. Spraying in Seed-beds and Lands, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

No. 938. The Destruction and Control of Locust Hoppers, by R. W. Jack, Chief Entomologist.

No. 942. Mycological Notes.—Seasonal Notes on Tobacco Diseases.—8. The Mosaic Mystery. 9. Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

No. 950. The Control of Tsetse Fly in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

No. 951. Suspected "Streak" Disease of Maize. Notice to Growers. By J. C. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

No. 962. The Report of the Chief Entomologist for Year ending 31st December, 1934, by R. W. Jack, Chief Entomologist.

No. 969. The Objects and Value of Seed Treatment of Maize against Diplodia, by G. M. Wickens, Ph.D. (Lond.), D.I.C., Assistant Plant Pathologist.

POULTRY.

No. 721. Poultry Keeping in Rhodesia: Pedigree Breeding, by H. G Wheeldon, Assistant Poultry Expert.

No. 738. Hints to Breeders—Rearing Young Stock, by A. Little, Poultry Expert.

No. 740. Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon, Poultry Expert

No. 761. Housing and Feeding of Adult Stock, by H. G. Wheeldon, Poultry Expert.

No. 795. The Turkey, by G. H. Cooper, Assistant Poultry Officer.

No. 803. Geese, by G. H. Cooper, Assistant Poultry Officer.

No. 827. The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.

No. 865. Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Chief Poultry Officer.

No. 870. Trap Nests, by B. G. Gundry, A.I.Mech.E. (combined with No. 875).

No. 872. The Poultry Industry: Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.

No. 875. Another Trap Nest, by B. G. Gundry, A.I.Mech.E. (combined with No. 870).

No. 884. The Vitamins in Poultry Feeding, by G. H. Cooper, Poultry Officer, Matopo School of Agriculture and Experiment Station.

No. 918. The Moulting of Poultry: The Normal and Pullet Moult, by H. G. Wheeldon, Poultry Officer.

No. 933. Ducks on the Farm (Revised), by H. G. Wheeldon, Poultry Officer.

No. 939. The Use of Galvanised Iron in the Making of Some Appliances for Poultry Keeping, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.

No. 940. A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station .

No. 947. Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.

No. 966. Egg Marketing Bill: Draft of a Bill having for its purpose the more orderly Marketing of Eggs.

No. 971. Feeds for Poultry and How to Use Them, by G. H. Cooper, Assistant Poultry Officer.

The following pamphlets can be obtained from the Poultry Expert upon application:—

Selecting Birds for Laying Tests, by A. Little, Poultry Expert.
Tuberculosis, by A. Little, Poultry Expert.
Prevention of Disease among Poultry, by A. Little, Poultry Expert.
Preparing Birds for Show, by A. Little, Poultry Expert.

The Fowl Tick (Argas persicus), by A. Little Poultry Expert.
Culling: A Seasonal Operation, by A. Little, Poultry Expert.
Choosing a Male Bird, by A. Little, Poultry Expert.
The Breeding Stock, by A. Little, Poultry Expert.
Diseases of the Digestive System, by A. Little, Poultry Expert.
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Partial Moult: Broodiness: Selection of Layers of Large Eggs, by A. Little, Poultry Expert.
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Green Food: The Result of not Supplying Sufficient to Poultry, by A. Little, Poultry Expert.
Good and Bad Hatching Eggs, by A. Little, Poultry Expert.
Grading Fowls, by A. Little, Poultry Expert.
Housing: Three Important Essentials, by A. Little, Poultry Expert.
Advice to Prospective Poultry Farmers, by A. Little, Poultry Expert.
Seasonal Hints- August, by A. Little, Poultry Expert.
Successful Chick Rearing, by H. G. Wheeldon, Assistant Poultry Expert.
Hints to Breeders, October, by A. Little, Poultry Expert.
Abnormalities in Eggs, by A. Little, Poultry Expert.
Hints to Breeders. Prepare for the Breeding Season, by A. Little
Respiratory Diseases, by A. Little, Poultry Expert.
Selection and Preparation of Fowls for Exhibition, by H. G Wheeldon, Poultry Expert.
The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 542. Review of the Abnormal Rainfall Season 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc. (Eng.).
No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.
No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.
No. 948. The Weather, contributed by The Meteorological Office.

AGRICULTURAL BUILDINGS.

No. 554. Pisé-de-Terre, by P. B. Aird.
No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.
No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
No. 863. Piggeries, by B. G. Gundry, A.I.Mech.E.
No. 889. The Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.

No. 902. Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E.
No. 908. A Charcoal Safe or Cooler, by B. G. Gundry, A.I.Mech.E., Irrigation Division.
No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by B. G. Gundry, A.I.Mech.E.,
No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.,
No. 941. A New Type of Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.

MISCELLANEOUS.

No. 518. Locusts as Food for Stock, by Rupert W. Jack, F.E.S.
No. 686. The Land Bank, Its Functions and How it Operates, by S. Thornton.
No. 687. The Use of Explosives on the Farm, by P. H. Haviland, B.Sc. (Eng.).
No. 702. Book-Keeping on the Farm, by T. J. Needham, Acting Accountant, Agricultural and Veterinary Departments.
No. 707. Wood-Charcoal in Southern Rhodesia, by T. L. Wilkinson, B.Sc., Assistant Forest Officer.
No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 849. The Preservation of Farm Beacons, by L. M. McBean, Acting Surveyor-General.
No. 852. Mixing of Fertilisers: A Guide to Methods of Calculation, by the Division of Chemistry.
No. 858. The Softening of Waters, by the Division of Chemistry.
How to Make Use of the Fencing Law.
Twelve Simple Rules for the Avoidance of Malaria and Blackwater.
Summary of the Game Laws of Southern Rhodesia.
No. 910. The Toxicity to Grazing of Grass Sprayed with a Solution of Sodium Arsenite, by A. D. Husband, F.I.C., and J. F. Duguid, M.A., B.Sc.
No. 930. Analyses of Rhodesian Foodstuffs, by The Division of Chemistry.
No. 931. Charcoal-Gas as Fuel for Farm Tractors, by W. F. Collins, Assoc.R.S.M., "Riverside," Marandellas.
No. 935. The Weeds and Poisonous Plants of Southern Rhodesia, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture. Part I.
No. 949. Report of the Branch of Chemistry for year ending 31st December, 1934, by A. D. Husband, F.I.C., Chief Chemist.
No. 953. A Scraper for Levelling Land, by D. E. A. Gutsche, Field Husbandry Officer, Kakamas.
No. 954. Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts, by J. K. Charley, F.R.E.S., and R. McChlery, B.A., B.Sc.
No. 958. A Cheap Levelling Device, by A. W. Laurie, Howick Vale, Concession.
No. 961. A Home-made Ridger. Contributed by Mr. Douglas Aylen, Somerset, Concession.
No. 975. Fertilizers, Farm Foods, Seeds and Pests Remedies Ordinance, 1914.
No. 979. The Prospects of Black Bass in the Inland Waters of Southern Rhodesia. Specially contributed.
No. 983. Annual Report of the Branch of Chemistry for year ending 31st December, 1935, by A. D. Husband, F.I.C., Chief Chemist.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed: The Art Printing Works, Ltd., Box 431, Salisbury.

Do Composts Carry Disease?—In view of the fact that greater use is now being made of composts a letter was addressed to the Director of the Imperial Mycological Institute asking if he could supply any information as to whether the use of composts made from maize crop remains would be likely to increase the danger of diplodia infection in future crops. The following is an extract from Dr. Ashby's reply:—

"Replying to your letter of the 20th March, I believe that there would be very slight and probably no risk of spreading the maize diseases caused by *Diplodia zeae* and *Gibberella saubinetii* by adopting the Indore method of composting the stalks, trash and mouldy cobs, provided the material is suitably prepared and the method properly carried

out. The optimum temperature for the germination of the spores and the mycelial growth of *Diplodia zeae* lies between 80° and 86° F. and the maximum between 95° and 104°; a temperature 10° higher than the maximum if maintained for a relatively short period under the conditions of aeration and humidity of the fermenting mass would destroy that fungus and other pathogenic fungi. In a normal fermentation the temperature during the first few weeks may rise to about 150° F. and be maintained near that for a considerable time; such a temperature under the moist conditions of the fermentation must be rapidly destructive to the pathogenic fungi.

"I have been unable to find direct references in the literature to the effect of the Indore method upon the survival of *Diplodia zeae* and other fungi causing cob rot and seedling blight of maize, but as I have indicated the indirect information seems convincing. I have seen a reprint with appendix of Sir Albert Howard's lecture on the 22nd November, 1935, before the Royal Society of Arts and have noted the following statements:—

"p. 8. Dr. Horler using materials collected on a tea estate in Travancore and fermented in pits founds that a temperature of 150° F. was attained three weeks after charging the pits.

"p. 43. Sir Albert Howard says: 'During the first month fungi are engaged in breaking down the organic matter. The heaps should then be a mass of white fungoid growth and the temperature should be high. After the third week the mass darkens rapidly and becomes crumbly while there is a slight fall in temperature. Bacteria from now onwards take an increasing share in humus manufacture. If at any time the fermentation stops and the pits cool, want of moisture is the most likely cause.' "

Chilled Beef: Agreement Regarding Prices.—Certain prices were published in the local Press during January which have now been revised for the year ending March 31st, 1937. As a result of an agreement reached between the Government of

Southern Rhodesia and the Rhodesia Export and Cold Storage Co., Ltd., for the payment of guaranteed prices to producers of meat suitable for export trade, the Rhodesia Export and Cold Storage Company undertakes to pay the following minimum prices per 100 lbs. on the ascertained dressed weight of cattle delivered on leg at its works, for standard grade chilled meat :—

April, 1936...	22/-	per 100 lbs.
May, 1936	22/-	,,
June, 1936	22/6	,,
July, 1936	23/-	,,
August, 1936	23/6	,,
September, 1936	24/-	,,
October, 1936	24/6	,,
November, 1936	25/-	,,
December, 1936	25/6	,,
January, 1937	24/6	,,
February, 1937...	23/-	,,
March, 1937...	22/-	,,

For all chilled beef graded "Imperial" the Company undertakes to pay an additional 2/- per 100 lbs. dressed weight.

Under this price scheme the hide and the offal of cattle will be sold to the account of the Company.

Giant Witch Weed (*Striga hermonthica*).—This species of witch weed is the variety commonly found in Kenya Colony growing on maize, sugar cane, and sorghums. It has flowers of a similar shape to those of *Striga lutea*, but they are somewhat larger, and the colour varies from a delicate rose pink (almost white) to a light brick red. Its stems are seldom if ever branched, and it reaches a height of up to 2½ feet.

Until recently its presence had not been reported in Southern Rhodesia, but about three years ago it was reported occurring on a farm near Umtali, and about a year ago it was found on a farm near Hartley, where it was said to have been growing on the roots of a M'sasa tree, though this is unlikely.

This year it has made its appearance on another farm near Hartley, where it is parasitic on maize, and a patch of fair size was found, showing that it had been established there for several years.

Since it appears to produce few seed capsules compared with the number found on *S. lutea* it is thought that it will not prove so difficult to eradicate as the latter or spread so rapidly.

Similar methods of control to those used against *S. lutea* will be equally effective against *S. hermonthica*.

Farmers who discover this variety of witch weed on their farms are requested to inform the Department of Agriculture with brief details of the area affected and the host crop.

Agricultural Shows during 1936.—The following is a list of Show dates which have been fixed up to the present:—

Bindura.—July 25th.

Umtali.—August 7th and 8th.

Salisbury.—August 20th and 21st.

Bulawayo.—August 28th and 29th.

Gatooma.—September 4th. Show sale Saturday 5th.

Kafue.—July 13th and 14th.

Johannesburg.—September 1st and 2nd.

Potatoes: Acceleration of Sprouting.—Farmers who grow potatoes under irrigation for the early market during the winter often have difficulty in securing sprouted "seed" for planting, or inducing their own "seed" to sprout sufficiently early. Some growers of main crop potatoes, too, who prefer to use "seed" grown under irrigation in winter, have a similar difficulty. A solution of this problem has been tested at the Agricultural Experiment Station, Salisbury, during experiments on fumigating potatoes with carbon bisulphide to kill "tuber-moth."

The tubers should be placed in an air-tight room, or receptacle, such as a corrugated iron tank. A pit in the ground covered with a tarpaulin has not proved satisfactory, probably owing to the vapour being absorbed by the earth. On the other hand a tarpaulin covering to an iron tank would be satisfactory, since the vapour is 2.6 times heavier than air, and so will not tend to rise and find its way through the tarpaulin.

Carbon-bisulphide should be placed in shallow trays or dishes on the top of the "seed" tubers and the room or receptacle closed. The liquid evaporates readily on a warm day, and the vapour being heavier than air, flows over the sides of the trays and fills the receptacle. It is advisable to commence the treatment on a warm morning, so that the liquid will evaporate rapidly. The tubers should undergo the treatment for 24 to 48 hours, and two tablespoonfuls of the carbon bisulphide are required to each cubic yard, or 27 cubic feet of volume of the receptacle, irrespective of whether the latter is filled with tubers or only partly so. Within ten days about 75 per cent. of the "seed" should be commencing to sprout. When sprouting has commenced, it may be further accelerated by placing the tubers in a gently warmed tobacco barn or in a warm room, in which the air is kept reasonably moist. It is useful to know that carbon bisulphide is sold by the pound weight. One pound is equivalent to approximately 13 ounces (liquid measure), or 26 tablespoonsful.

Export of Turkish Tobacco to Union.—Attention is drawn to section 6 of the Turkish Tobacco Export Act, 1936, which reads as follows:—

(1) After the 30th June, 1936, no person shall export any Turkish tobacco from the Colony to the Union of South Africa unless he has a permit so to do issued by the Minister in terms of this Act and no officer of customs shall accept any bill of entry for such export unless it is accompanied by such permit.

(2) Applications for permits shall be made in writing to the Minister in the form set out in the Schedule to this Act and a separate application shall be made for each and every consignment.

(3) The Minister shall grant an application if the amount of the consignment to which the applications relates, together with any amounts grown by the same grower or by the same association of growers for which permits have been granted in the same year, is—

(*a*) in the case of an individual grower, within the export quota allotted to that grower for that year; or

(*b*) in the case of an association of growers, within the aggregate of the export quotas allotted to the members of that association for that year.

(4) Any person who exports tobacco contrary to the provisions of this section shall be guilty of an offence and liable to a penalty of one shilling for every pound weight of tobacco which he has exported.

Notice to Tobacco Growers.—In terms of section 28 of the "Tobacco Marketing Act, 1936," it is the duty of every grower to whom a sales quota has been allotted, to submit to the Secretary, Department of Agriculture and Lands, P.O. Box 387, Salisbury, in writing, *not later than the 15th of June*, 1936, the following information:—

(1) Name of grower.

(2) Registered number.

(3) Name of farm on which tobacco was produced by the grower during the season 1935-36.

(4) Estimated total weight of saleable tobacco harvested by the grower during the season 1935-36.

(5) Whether the weight of saleable tobacco harvested by the grower is sufficient to supply the full amount of tobacco covered by his sales quota certificate. If not, then the weight of the shortfall is to be stated.

(6) Whether the estimated total weight of saleable tobacco harvested by the grower during the season 1935-36 is in excess of his sales quota; if so, the weight of such surplus should be stated.

Bloodmeal Fertiliser and Tobacco Spot.—A letter has been received from Captain J. M. Moubray, of Chipoli, raising a question which has been troubling the minds of tobacco growers for some time. This was referred to the Acting Chief Chemist and the Senior Plant Pathologist, who have supplied a few notes on the subject.

Captain Moubray wrote as follows:—"Spot of different kinds has been fairly prevalent this season among tobacco. A quantity of fertiliser used in the growing of tobacco contains a certain amount of bloodmeal. Has the relationship of bloodmeal to the prevalence of spot ever been considered? There is nothing better for the incubation of bacterial diseases than blood.

"Years ago I used to apply a fertiliser containing bloodmeal then I gave it up and only tried bloodmeal as a constituent of my mixture again this season.

"The fact was outstanding that in those fields where the dressing contained bloodmeal spot was bad, whereas in those where there was no bloodmeal the spot infection was normal. Of course, this may only be a coincidence.

"In the last number of the *Journal* there is an interesting description of various nitrification experiments. It is stated that at the end of three months only 54.5% of the bloodmeal was nitrified. What about the rest? Does it remain in the soil and act as a disease-carrier to transmit spot to the next crop? If it remains without being decomposed it cannot but become infected by the drip of rain water from spot-infected leaves. During the dry season this residue would remain more or less dormant and again become active with the advent of the rains."

The Senior Plant Pathologist states:—"I very much regret that I am unable to put forward experimental evidence which would settle the point raised by Captain Moubray regarding any constant relation which may exist between the use of bloodmeal fertiliser and the prevalence of bacterial diseases in tobacco.

"I am unable to agree that there is no better medium than blood for the incubation of these diseases, for where this

question has been experimentally investigated it has been found that bacteria most commonly pass the winter in fragments of plant débris. In cases where this débris becomes decomposed and the bacteria are released into the soil, then various parasites become active and destroy the pathogenic organisms.

"Of course, there is a definite relation between the presence of more bloodmeal than is required by the plant in any particular season and the presence of 'spot,' if the latter term refers to Red Rust. This, however, is not a bacterial disease, and seems to occur whenever unbalanced nitrogen is present in excess, whether derived from bloodmeal or other type of fertiliser. It has been my experience that under certain conditions, particularly where heavy late rains follow a drought period, all organic fertilisers do tend to favour the development of leaf spots, but I attribute this to the 'secondary' growth of the plant induced by the liberation of available nitrogen, which produces a 'sappy' leaf suitable to the development of bacteria and consequent enlargement of spots already formed.

"A somewhat similar case is to be met with when inorganic nitrogen only is used in the fertiliser, and 'forcing' weather is experienced earlier in the season. It is pretty safe to say that any rapid absorption of nitrogen, whether derived from bloodmeal or any other source, which causes 'forced' growth in the plant, will also favour the development of leaf spots due to bacteria and abnormal metabolism.

"The ideal, of course, is to find the perfectly balanced fertiliser for each season and to apply only the exact amount required by the plant in order to maintain disease resistance at its maximum; but if this were possible, I am afraid tobacco growing would lose many of its thrills!"

The Acting Chief Chemist writes:—"In connection with the reference Captain Moubray makes to the report of this Branch, at the end of three months 54.5% of bloodmeal was found to be nitrified, but this does not take into consideration what was ammonified. Judging from preliminary results of experiments taking place during the present season, the ammonified nitrogen may be taken to be about 16% of the

nitrified nitrogen, *i.e.*, 9% of the bloodmeal. Adding this to 54.5%, we have approximately 64%, leaving 36% bloodmeal unchanged at the end of the third month.

"It is highly probable, in fact almost certain, that considerably more ammonification and nitrification will occur after the third month, but let us assume for the moment that no more does.

"The usual bloodmeal tobacco fertiliser is one containing 6% nitrogen, of which one-third, or 2%, comes from bloodmeal. Bloodmeal, on an average, consists of 12% nitrogen, and the usual application of this fertiliser is 150 lbs. per acre. Total bloodmeal applied to one acre of soil is therefore 25 lbs. Of this 36% is unchanged, or 9 lbs.

"The weight of one acre of average surface soil 6 inches deep is taken on a conventional basis to be 1,000 tons.

"So we have 9 lbs. of bloodmeal distributed throughout 2,000,000 lbs. of soil, or 1 part in 220,000, surely too minute a proportion to have any appreciable effect as a culture medium compared with the amount of organic matter normally in the soil."

Southern Rhodesia Milk Recording Scheme.

The following regulations for the official and semi-official milk recording and testing of dairy herds in Southern Rhodesia are reprinted for general information.

GENERAL CONDITIONS.

(1) Whenever possible, the Official Milk Recorder will be present at the milking previous to the first milking taken for the check test in order to see that the cows are all milked dry.

(2) No test for butter fat will be taken by the Recorder until eight days have elapsed since the cow calved, or until such time as her milk, when boiled, does not coagulate.

(3) All records shall commence not earlier than the fifth day after calving, the day on which the cow calved being counted as the first day.

(4) There shall be not less than two or more than three milkings in the twenty-four hours, provided that the Chief Dairy Officer may grant permission for a cow yielding over eight gallons per diem to be milked four times daily. The number of milkings per diem shall be stated on the certificate or statement of performance when issued.

(5) The Government shall have the right to make use of the data obtained in respect of the testing and recording of grade and pure-bred herds for propaganda or other purposes, provided that the names of the owners or breeders and the names of their animals shall not be published without the consent in writing of the farmers or breeders concerned.

(6) All farmers or breeders whose herds are recorded and tested must furnish brief particulars of the feeding of the cows under test; such information to be entered by the owner or his representative each month on the weights sheet. The quantity of concentrates or roughage fed daily and the condition of the veld, if running on same, must at least be stated.

(7) Notwithstanding what is laid down in regulation 5, the completed records of all cows in respect of which a certificate or statement of performance has been issued, together with the names of the owners and, whenever possible, brief particulars of feeding, will be published from time to time in the *Rhodesia Agricultural Journal* or in such other publication as the Department may approve of, provided that no records will be published in any publication other than an Agricultural Journal without the consent in writing of the owners or breeders concerned. Similarly herd averages may be worked out annually and published in the same Journal.

(8) All testing fees shall be paid to the Milk Recorder upon the occasion of each visit; fees for surprise tests, however, as provided under regulation 24 (g), may be paid to the Milk Recorder on his subsequent visit to the farmer or dairyman concerned.

The Department shall have the right to refuse further service and to cancel the Milk Recorder's visits to any farmer or breeder who fails to comply with this requirement.

(9) All breeders, farmers and dairymen whose herds are officially or semi-officially recorded and tested will be required to provide the Milk Recorder with suitable board and lodging, free of charge, during the whole of the period it is necessary for him to remain on their property. When considered necessary, they may also be required to convey the Recorder, free of charge, from the railway station to the farm, and likewise convey him back to the railway station or to the next farm he has to visit, as the case may be.

(10) The Chief Dairy Officer shall have the right to refuse to issue a certificate or statement of performance in respect of any cow in regard to the accuracy of whose record he is not satisfied.

(11) (*a*) The feeding of whole milk, cream or eggs to cows under test is prohibited, as is also the dosing of them with stimulants, medicines or concoctions calculated in the opinion of the Chief Dairy Officer to temporarily and abnormally affect their production, and certificates will not be issued on records published in respect of cows so fed or treated.

(a) Owners may be required to furnish the Chief Dairy Officer a declaration as to the foods and quantities of each comprising the rations fed to their cows during the period they are under test, and, if deemed necessary, must permit samples of the different foods to be taken for analysis.

(12) Notwithstanding anything to the contrary which may appear to be indicated in these regulations, no person shall have the right to demand the services described in this scheme, if for any reason whatsoever the Department is not in a position to provide such services.

(13) In the event of any difference of opinion in regard to the interpretation of any of these regulations, or in the event of any question arising for which no provision is made in these regulations, the Chief Dairy Officer shall be the sole arbiter in such cases, and his decision in the matter shall be final

(14) Copies of these regulations can be obtained from the Chief Dairy Officer, Department of Agriculture, Salisbury.

OFFICIAL MILK RECORDS.

Only pure bred registered cows, which shall include all animals registered in the South African Stud Book or other recognised South African or Overseas Herd Book, shall be officially recorded and tested.

(15) All pure bred registered cows entered for the official test shall be submitted, once in every thirty days, to a forty-eight hours' check test by the Department's Official Milk Recorder; during this period the milk of each cow shall be weighed and tested for butter fat at each and every milking.

(16) The official testing and recording of a herd of less than 10 cows will only be undertaken if circumstances permit.

(17) The following scale of fees will be charged to breeders or farmers who agree to enter their whole herd for the official test and who undertake to comply with the conditions laid down in regulation 18.

(a) The minimum charge for a visit by the Department's Official Milk Recorder shall be £1.

(*b*) For this fee the breeder or farmer will be entitled to have up to 10 cows officially tested at the same time and on the same premises.

(*c*) For every cow above 10, the fee for official testing will be 1s. per cow per visit.

(*d*) Breeders who have entered their pure bred herd for official test and who desire also to have unregistered or grade cows tested at the same time and on the same premises will be charged at the rate of 3d. per grade cow per visit. Only a 24 hours' check test will, however, be taken of such unregistered or grade cows.

(18) All breeders wishing to avail themselves of the scale of charges provided in the foregoing regulation shall, when applying to have their herds tested, undertake to comply with the following conditions, *viz.*:—

(*a*) Every cow in the herd must be officially tested and recorded as she calves down and every time each calves so long as the herd is under official test: provided that exemption may be obtained from the Chief Dairy Officer in respect of cows suffering from sickness or accident or for other special reasons which, in the opinion of such officer, constitute sound and valid grounds for granting exemption; no such exemption, however, shall be granted on account of adverse climatic conditions except in very exceptional and abnormal circumstances.

(*b*) No cow shall be withdrawn from the official test before she has completed 300 days from the commencement of her record or has ceased to yield milk before the expiration of that period except in cases of sickness or accident, when permission to withdraw may be granted by the visiting Official Milk Recorder, who shall then report the circumstances to the Chief Dairy Officer, who may, if in his opinion there is no justification for withdrawal, require the cow to complete the test.

(c) The keeping of daily weights will be optional, and owners preferring not to keep such will be allowed to record the weight of milk yielded by each cow at each milking on two days each week: the days on which the weights are to be taken must be stated by the owner when making application to have his herd tested, and shall be rigidly adhered to unless permission to alter them is obtained from the Chief Dairy Officer. In cases where daily weights are not taken, the total weight of milk for the month (30 days' period) shall be calculated by multiplying the average daily weight of milk yielded on the days the milk has been weighed by 30; the weights of milk recorded by the Official Milk Recorder during his forty-eight hours' test also being reckoned for this purpose.

(d) Official certificates of performance shall be issued in respect of cows which complete a minimum of 240 days under test or which qualify within that period in respect of butter fat requirements for the Advanced Register, Register of Merit, Shorthorn Dairy Record Standard, or any other standard accepted by any recognised Breed Society, and, at the discretion of the Chief Dairy Officer, in respect of such cows which may have died during test or been withdrawn owing to sickness or accident before the expiration of that period. All such certificates shall be endorsed stating whether the record has been based on daily or twice-weekly weighings. No certificate, however, shall be issued for a cow until she has re-calved after completing her test or has failed to re-calve at the expiration of eighteen months from the commencement of her test, whichever is the earlier date. Date of calving shall be entered on the certificate or, in the event of failure to re-calve

within eighteen months, a note shall be made to that effect. Owners not requiring certificates for any particular animals must notify the Chief Dairy Officer to that effect as soon as the cow concerned has completed her test; otherwise certificates will be issued for each animal recorded.

Official certificates issued in respect of pure-bred registered cows shall be forwarded to the Breed Society or Association concerned, from whence they will be returned to the breeder or owner.

(19) Breeders who are unwilling to submit their whole herd for the test, but who wish to have only a few selected animals tested, shall be allowed to have such officially tested under the following scale of charges:—

(*a*) The minimum charge for a visit by the Department's Official Milk Recorder shall be £2.

(*b*) For this fee the breeder will be entitled to have up five cows tested at the same time and on the same premises.

(*c*) For every cow above five the fee for official testing will be 2s. per cow per visit.

(20) Breeders who enter cows under this regulation must record the weight of milk yielded by each cow under test at every milking, and the conditions relative to the issue of certificates laid down in regulation 18 (*d*) of this notice shall also apply to them.

(21) If at any time more applications for official recording and testing of pure-bred cows are received than can at the time be undertaken by the Department, preference shall then be given to applications for the testing of whole herds under regulations 17 and 18 of this notice.

(22) (*a*) Applications for the official testing and recording of pure-bred registered cows under this scheme must be made on the form issued for the purpose and obtainable from the Chief Dairy Officer, Department of Agriculture, Salisbury, to whom the form after completion must be forwarded.

(*b*) All entries of cows for the official test must be made before calving, and entries cannot be accepted in the case of herds in which cows are not already being tested unless completed application forms are sent in not later than twenty-one days prior to the date on which the first cow to be tested is expected to calve.

(*c*) All owners entering cows for the official test will be supplied free of charge with the necessary official weighing books in which to enter the weight of milk yielded by each cow.

(23) All official records shall be for a lactation period of 300 days; owners may, however, continue cows in test up to 365 days, and a statement of the performance during this extended period will be included in the certificate when issued

SEMI-OFFICIAL MILK RECORDS.

(24) Owners of pure-bred registered cows who do not desire to enter their herds for the official test, and farmers and dairymen who wish to record and test their herds of grade cattle, may place their herds under semi-official test, as provided hereunder:—

(*a*) In the case of herds which are placed under semi-official test the minimum charge for a visit by the Department's Official Recorder will be 7s. 6d.; for this fee the farmer will be entitled to have up to 10 cows tested at the same time and on the same premises; for every cow over this number the fee for testing will be 3d. per cow per visit.

(*b*) Only cows whose calves are hand-reared shall be recorded and tested.

(*c*) Every cow in the herd must be recorded and tested every lactation, so long as the herd is under test; if the owner refuses to agree to this stipulation, the Department shall refuse to record and test his herd. Cows suffering from sickness or accident, and such as are over 10 years old or for any other valid reason, may be exempted at the discretion of the Milk Recorder.

(*d*) Each cow shall be submitted once in every 60 days to a 24 hours' check test by the Department's Milk Recorder; during this test period the milk of each cow shall be weighed at each and every milking, and a composite sample of the morning's and evening's milk of each cow shall be taken and be tested for butter fat.

(*e*) The keeping of daily weights shall be optional, and owners preferring not to keep such may record the weights of milk on one fixed day in each week and have the two months' yield worked out from the average of such weights and those obtained by the Recorder during his 24 hours' check test. Weighing sheets will be provided free of charge. All weighing sheets must be kept up to date and will be collected every 60 days by the Milk Recorder.

(*f*) The semi-official testing and recording of a herd of less than ten cows will only be undertaken if circumstances permit.

(*g*) In addition to the bi-monthly visits from the Milk Recorder as provided under (*d*), surprise visits may also, and at any time, be paid by the Milk Recorder to farmers or dairymen whose herds are recorded under this scheme; during these surprise visits each cow under test shall be submitted to a 24 hours' surprise check test. The expense of one such surprise test, if made, shall be borne by the farmer or dairyman concerned, and the fees charged therefor shall be as provided under (*a*).

(25) No cow, unless she has ceased to yield milk, shall be withdrawn from the test unless permission for withdrawal has been obtained from the Milk Recorder.

(26) Statements of performance will be issued in respect of each cow which produces a minimum of 180 lbs. of butter fat during a lactation period of not more than 300 days.

(27) Application for the semi-official testing and recording of dairy herds shall be made on the form supplied for the purpose and obtainable from the Chief Dairy Officer, Depart-

ment of Agriculture, Salisbury, to whom the form, after completion, should be forwarded. Entry forms, which can be obtained from the Chief Dairy Officer, must be filled in by the farmer or dairyman concerned for each cow entered for the semi-official test; these forms must be handed to the Milk Recorder to identify each cow tested, the owner must brand or mark each animal in manner approved by the Milk Recorder, and must renew such brand or mark from time to time as may be necessary, except in the case of broken colour animals, which can be identified by means of the colour diagrams on the back of the entry form.

(28) The testing and recording of any grade herd under this scheme may be discontinued at any time if, in the opinion of the Chief Dairy Officer, the owner of such herd is not deriving full advantage or benefit from this service.

Annual Report of The Agriculturist,

FOR THE YEAR 1935.

By D. E. McLoughlin, Agriculturist.

Season and Crops.—After a very promising opening the season proved a most disastrous one to farmers. The opening rains provided ideal planting conditions with a total precipitation in most parts of four inches by the end of November, and coupled with fine rains early in December provided a good germination.

The year closed with copious rains, but towards the end of December the maize crop began to suffer from the lack of sunshine. The rains in January were continuous up to the middle of that month; fine weather then followed with drying easterly winds and to an extent eased the uncertain position of the maize crop, which was by then suffering badly from excessive moisture and lack of sunshine experienced during the previous eight weeks.

The rainfall during February was very patchy and drought conditions were general throughout the main maize areas. Favourable rains, however, were recorded in the Midlands and Matabeleland with more promising results.

The February drought was followed by a serious and prolonged drought in March, and the two to three inches of rain which fell towards the end of that month in the main maize belt of Mashonaland arrived too late to exercise any beneficial effect on crops. The prospect of a good season in Matabeleland was ruined by an even shorter rainfall in March than that recorded in Mashonaland.

Maize.—The excessive rains in December and January severely affected the normal growth of the crop and the impaired root system developed under cold and water-logged

soil conditions provided a poor insurance against the severe drought experienced during the remainder of the season. Maize growers suffered in particular and a large majority only reaped a 50% crop. Growers, however, will receive some compensation for their reduced outputs in the higher average price of maize, through local sales, and by the reduced export of only 92,450 bags to date.

The total maize acreage planted by European farmers was 266,426 acres as compared with 246,371 acres in 1933-34. Total production was 1,269,185 bags, or 4.76 bags per acre as against 1,728,065 bags, or 7 bags per acre, in the previous year.

Ground Nuts.—The acreage planted to ground nuts decreased from 7,109 to 6,609 acres. The yield was only 49,423 bags, or 7.5 bags per acre, as compared with 76,020 bags, or 10½ bags per acre, for the previous year. The output has again proved insufficient to meet local requirements, but despite the shortage, local prices remained at a low level. The low but slightly firmer prices paid overseas for ground nuts for the oil trade still precludes the possibility of growing ground nuts for export as a side line or alternative crop to maize. The crop has for many years proved an unstable commodity as an European crop in this Colony, and with the one exception of the trade in "specially hand selected ground nuts in shell" it has not yet proved remunerative to export ground nuts overseas in competition with other countries, such a China and India. The crop is one which can be grown over large areas of Rhodesia by both European farmers and natives, and if remunerative markets could be found it could takes its place as a major crop.

Sunflower.—The acreage planted to sunflower for grain was 7,352 acres and yielded 31,425 bags, or 4.3 bags per acre. An additional 8,997 acres were planted for green manuring. Late planting and the early cessation of the seasonal rains are the main factors responsible for the low yield. The crop, however, does not receive serious attention by farmers and is usually planted on indifferent soil and accorded very little attention in the way of fertiliser treatment and cultivation.

Green-manuring and Rotation Cropping.—The total acreage under green manure crops was 48,112 acres, of which total 32,532 acres were under sunnhemp and 8,997 acres under sunflower, the remainder was planted to velvet and dolichos beans and sorghums, the latter as a trap crop for witch weed. The acreage represents 18 per cent., or approximately one-fifth, of the total acreage planted to maize.

It is satisfactory to record the steady improvement in the cropping system adopted by the agricultural community as a whole, particularly in the essential practice of green-manuring and the introduction into the cropping programme of sunflowers or legumes for seed or fodder. The position is more clearly indicated in the following table:—

Acreage under maize	266,426 acres.
Acreage under green manure crops	48,112 ,,
Acreage under ground nuts and other leguminous crops reaped...	22,839 ,,
Acreage under sunflower for seed...	31,425 ,,
Total	368,802 ,,

The greater frequency of green-manuring, in conjunction with the use of heavier dressings of artificial fertilisers, for maize, as a practical and economical means of increasing yields, is receiving greater consideration by the larger growers, several of whom have adopted a three course rotation, growing two crops of maize after a green manure crop ploughed under. This practice is advocated and confirmed by results obtained on the Salisbury Experiment Station, which indicates that the beneficial effects of a green manure are more economically utilised by two successive crops of maize only. It is conceivable that if the three course system was more generally practised by maize growers higher average yields per acre should be secured which would more than compensate the grower for the additional acreage thrown out of maize. This would reduce the cost per bag. The testing, selecting and general distribution of the heavy seeding Somerset variety of sunnhemp by the Salisbury Experiment Station has considerably reduced the cost of green-manuring and greatly increased the popularity of this crop for that purpose.

The practice of sowing a mixture of half and half sunflower and sunnhemp, as an insurance against certain insects and diseases attacking one crop is still practised to a lesser extent.

The fact that the season's maize crop was variously estimated by many experienced growers and others at less than 1,000,000 bags, or a quarter of a million bags less than the actual yield, reflects favourably on the sound principles of agriculture adopted in the Colony.

Wheat.— For the second year in succession frost again caused damage to the wheat crops in the Charter and Chilimanzi areas. The frost on the night of the 17th August was considerably more severe and damaging than the one in September of the previous year. It was reported that many farmers operating on vlei land had reaped no crops and that in a large number of cases the quality was severely affected. The frost followed on ten days of the coldest weather experienced in the Colony for many years. It is, however, a significant fact that no damage occurred during the actual cold spell of ten days and that high temperatures succeeded this intense cold. The varying temperatures were apparently responsible for reducing the resistance of crops, which in many cases were completely destroyed, even though the plants were up to four feet high and in ear. This abnormal variation in temperatures is a factor which makes the task of the Plant Breeder a difficult one in evolving a frost resistant variety of wheat.

The damage by frost affected nearly 75 per cent. of the total acreage under wheat which was grown on vlei land.

As stated in my Annual Report for 1933, the practice of sowing wheat from the first week to the end of April is very general. The last few years have proved conclusively that it is definitely not safe to plant wheat in areas subject to severe frost before the second week in May.

It was, earlier in the season, fully anticipated that the crop would exceed the previous record crop by fully 40 per cent. The final estimate now places the crop at 45,000 bags from 19,000 acres, or approximately one-third of the Colony's requirements.

Efforts to find and establish a suitable summer green-manuring crop for vlei lands as a rotation crop for winter wheat to augment supplies of, or substitute kraal manure, were continued and several new introductions of crops were made from other countries. Thus far only partial results have been recorded with sesbania and sunnhemp. The low germination obtained with sesbania and the intolerance by sunnhemp of excessive moisture lessen their utility for the purpose. Growers are therefore advised at present to either grow sunnhemp on dry land and compost the crop, or to follow a winter rotation, including green-manuring, with vetches and peas.

Alternative Crops.—A report on Essential Oils, Drugs and Insecticides summarising the results obtained to date was published in the November issue of the *Rhodesia Agricultural Journal*. This report, "New Crops Tested Out," refers to *Pelargonium*, *Chenopodium*, *Datura stramonium*, *Pyrethrum*, *Mentha piperita* and *Plantago psyllium*. Other crops tested include *Hydnocarpus*, *Dolichos lupiniflorus*, *Neorautenenia fisifolia*, *Tephrosia Vogellii*, *T. toxicaria* and *T. Heckmannii*.

The Madagascar butter bean has proved its suitability as an alternative crop to maize or wheat when grown under partial irrigation in areas experiencing little or no frost, *i.e.*, in the districts of Shamva, Umtali and Ndanga. The crop is one which could be considered by settlers who will operate under the Umshandige irrigation scheme in the Fort Victoria district.

Witch Weed.—The Assistant Agriculturist, Mr. S. D. Timson, continued his investigations into *Striga lutea*, and the following extracts of his report are quoted:—

Witch Weed.—"The control of this parasite remains a serious problem to the maize farmers in all the areas comprising the maize belt, but it is now exceptional to find a farmer who is not doing his best to eradicate it by hand cultivation and trap-cropping.

Trap-cropping.—The practice of trap-cropping has extended considerably, particularly in the Mazoe Valley. The following statistics, supplied by the Statistical Bureau, show that a steady increase is taking place each year in the acreage placed under trap-crops:—

Year.	Acreage under trap crops.
1932-33	1,445
1933-34	1,796
1934-35	2,208

Evidence of a further increase is the fact that there was a shortage of amber cane and kaffir corn seed for this season's plantings. The spread of this, the cheapest and most effective method of control, has unfortunately been checked to some extent by the ill-effects noted on the following maize crop in some cases, resulting from nitrogen robbery from the soil, due to the ploughing under of the trap-crops at too mature a stage of growth. This danger of leaving trap-crops to mature beyond the two months period from germination recommended consistently by the writer, has been explained by him in lectures to Farmers' Associations and in articles in the local Press and in the *Rhodesia Agricultural Journal*, and it is hoped that the practice of trap-cropping will spread still more rapidly in the future.

Excellent results from trap-cropping are reported by many farmers, and it is now a routine practice on a number of farms.

It is now common practice to broadcast trap-crops on a stubble, without previous ploughing, and cover them by disc harrow.

The Irungu sorghum introduced from India was tested by several farmers during the past season. It proved to be identical with the local amber cane, except that it is considerably taller and grows to a height of about 15 feet under good conditions. It is a good host of witch weed, but does not at present promise any advantage over the local amber cane as a trap crop.

Native Sudan Grass.—(*Sorghum arundinaceum*) has also been issued to a number of farmers for trial as a combined trap crop and silage and hay crop. It appears to be an excellent host of witch weed, and as it is a perennial and a heavy seeder it promises to be of considerable value as a trap crop. Seed has been issued to a considerable number of farmers this year for further trial this season.

Munga.—Was tested as a host of witch weed, and it does not appear to be so resistant in this Colony as it is reported to be by Dr. Saunders at Potchefstroom.

Safe Interval between Cultivations.—The co-operation of a number of farmers was obtained in carrying out experiments to secure information concerning the "safe" interval permissible between hand cultivations of the parasite, and the results have been fully reported in an article by the writer in the *Rhodesia Agricultural Journal* (November, 1935). The results make it clear that no "safe" interval can apply to all conditions and all periods of the growing season. In other words, the farmer must judge by close observation when further cultivation is necessary.

Tours of Witch Weed Areas.—Several tours of the Mazoe Valley were made by the writer during the year in connection with witch weed control investigations, and a tour was also made to the Eastern Fort Victoria district and of the Lomagundi district.

Lectures on the subject were delivered to the Mazoe (Glendale) Farmers' Association and to the Poti Valley Farmers' Association, at their invitation.

The following articles were published on this subject by the writer:—

(1) Trap-cropping and Green-manuring. *Rhodesia Herald.* Show Number.

(2) Notes on Witch Weed Control. *Rhodesia Agricultural Journal*, 1935."

Maize Grading and Export.—Staff.—The only grain inspector appointed this year for the grading of the 1934-35 maize crop was Mr. S. W. Cherry. He served as temporary grain inspector for the period 28.10.35 to 30.11.35.

For the grading of the balance of the 1933-34 crop Mr. L. C. Roberts served as temporary senior grain inspector from 5.4.35 to 18.4.35, and Mr. S. W. Cherry served as temporary grain inspector for the same period.

Remarks.—Owing to the disastrous drought following the very heavy rains last growing season the quality of the maize on the whole was not up to the normal standard, much of the grain being poorly filled, and owing to the short crop only a small quantity was available for export as is shown by the figures below, supplied by the Rhodesia Railways:—

Maize Exported during the year 1935.

To Beira—January to June: 1933-34 crop... ...	169,604	bags
—June to July: 1934-35 crop...	92,397	bags
Total	262,001	bags
To Bechuanaland	745	bags
Grand total	262,746	bags

Maize Graded during 1935.

1933-34 Crop—		
Graded by Government—Mashonaland ...	104,138	bags
Bulawayo	Nil	
Graded by Maize Control Board	94,802	bags
1934-35 Crop—		
Graded by Government—Mashonaland ...	35,400	bags
Bulawayo	15	bags
Graded by Maize Control Board	59,447	bags
Total	293,802	bags

Maize Meal.

Graded at Salisbury	Nil	
Graded at Bulawayo	3,337	bags
Total for year	3,337	bags
Sunflowers ... ... total	771	bags

Research on Wheat and Barley on Vlei Land.—Hillside Experiment Station.—The following information is given in the Report of the Plant Breeder, Mr. T. K. Sansom:—

Owing to the Plant Breeder's absence at the Tobacco Research Station at Trelawney until the 19th of March, the work of preparation was done much too late. In addition, the abnormally wet condition of the vlei delayed progress and in consequence the sowing of the wheat plots was ten days later than usual. The heavy rust infestation of the 1934 season made it possible to discard a large number of wheats, and during the past season 180 varieties and strains were under trial. Of these 24 were new introductions; 64 were crosses in the second generation; 8 were crosses in their fifth generation and the remainder (86) were wheats grown in previous seasons.

A.—A date of seeding trial, including seven varieties, was laid down, and sowings were made at approximately ten-day intervals from 11th April to the 16th June, making seven different sowings in all.

B.—A rate of seeding trial rising from 20 lbs. per acre by 10 lbs. to 90 lbs. per acre was also laid down.

No conclusive results can be expected from the above two trials until they have been repeated over a number of years, but the following observations on the first year's results are of interest.

(1) The highest rate of seeding (90 lbs. per acre) gave the highest yield.

(2) The rate of seeding per acre did not affect the bushel weight of the resulting wheat.

(3) The protein content of the wheat was not affected by the rate of seeding per acre.

(4) The sowings made between 1st May and the 20th May gave the best results, but it must be borne in mind that the local conditions were exceptional.

C.—A series of fertiliser trials was also laid down on 66 plots of 1/80th acre, eleven treatments being replicated six times, on six randomised blocks.

For reasons briefly mentioned above preparation of the land for this trial was delayed until after mid-May, and it was not sown until 29th May. Despite these adverse conditions the results showed a gradual rise in yield corresponding with the generosity of the fertiliser and manurial treatment. Neither the protein content nor bushel weight of the wheat showed any significant variation ascribable to variation in fertiliser and manurial treatment.

Barley.—Nine varieties were sown which have been grown previously and four new introductions. Selections for a suitable malting type were made.

Green Manure Trials.—Eleven different crops were sown, but owing to the unsuitability of the land and late sowing no results were obtained. The trial is being continued under more suitable conditions.

General Remarks.—Owing to the extremely wet condition of the soil growth was very poor in the beginning, but improved later, and yields and quality of the wheat were excellent. Rust was almost entirely absent and a notable feature was the cleanness of the straw of all the wheat. Protein content was slightly lower owing to lateness of ripening and possibly excess of moisture in the soil. The quality of the grain was far superior to that of previous seasons.

The bushel weights of the grain are exceptional, many wheats have a bushel weight of over 70 lbs., and some have gone as high as 71½ lbs., which must surely approach a record figure.

Co-operative Trials on the British South Africa Company's Estate at Mazoe.—The two Rhodesian Reward strains supplied by this Department the previous year were again sown and the results were most encouraging with regard to the protein content, which was extraordinarily high.

Reward B 23-25 S1 had a protein content of 17.54% and Reward B 21-22 S 1. had a content of 16.75% protein. These figures show an increase over last season's, which is probably due to (1) seasonal conditions and (2) a change in the method of application of water.

In the Variety Trial mentioned below, of the sixteen different varieties grown, the lowest protein content yielded on analysis was 13.94%.

These results and others obtained elsewhere demonstrate that highly proteinous wheat can easily be grown in this Colony.

Variety Trial.--Sixteen varieties, comprising the most promising varieties hitherto grown on the Department's Wheat Experiment Station, were included in this trial.

The trial was laid down in the form of four randomised blocks of the sixteen varieties.

All the varieties made excellent growth, and it is greatly to be regretted that it was not found possible to reap the plots and obtain the yields, as these would undoubtedly have given very valuable data, which are at present almost entirely lacking, of wheat yields under irrigation in the Colony and also concerning the most suitable varieties for growing under these conditions on heavy soils.

It is desired to acknowledge the valuable co-operation of the Superintendent of the Mazoe Citrus Estate and of Mr. Farquar, who whole-heartedly gave so much of his time and energy to the work.

Co-operative Wheat Experiments on Vlei Land.—In addition to the Wheat Variety trial of ten varieties which was continued during the year in co-operation with Mr. E. G. Raubenheimer on his farm at Umvuma, a rate-of-seeding trial was also commenced with rates of seeding increasing by ten pounds from forty pounds up to eighty pounds per acre.

In the variety trial a hybrid of Quality and Rhodesian "Reward" wheat, bred by the Plant Breeder, was substituted for Reward 21-22 S 1., since the latter was judged to be inferior to Reward 23-25 S 1., which is continued in the trial.

The results of these two trials to date are tabulated below.

Variety Trial.

Design.—Four randomised blocks of ten varieties. Combined results of two seasons.

Variety.	Early Gluyas.	Quality.	"X."	Kenya Governor.	Lal Kasair Wali	Karachi.	Riverina.	Punjab 8a.	Reward 23-35 S 1.	Garnet.	Standard error of mean yields.
Mean yields per acre (in bags 200 lbs.) ...	8.01	6.40	5.97	7.27	7.63	6.03	6.84	8.13	6.47	7.60	0.2875 bags
Percentage of mean yield 6.92 bags ...	113.7	90.9	—	103.2	108.4	85.6	97.2	114.1	91.9	107.9	4.08

Calculated value at the 0.01 point of z x 1.02461—observed value of Z=.5189 (approx). The standard error of a difference between plot yields is 0.41 bag per acre.

Therefore the difference between mean yields greater than 0.82 bag per acre may be judged as being significant.

The above mean yields are the means of a total of eight plots or four plots of each variety in each of the seasons 1934 and 1935.

The value obtained for z= 1.02461 shows that the results are clearly significant.

The variety named "X" in the above table is a combination of Reward 21-22 S1 grown in 1934, and the hybrid "Quality" x Reward grown in 1935 and is only included for the purposes of statistical analysis.

On the yields of the year 1935 only, Quality x Reward yielded less than any other variety, but the results of that year alone are not significant owing to soil heterogenity.

Rate of Seeding Trial.

Design.—Four randomised blocks of five rates of seeding.

Variety of wheat.—Kenya Governor.

Rate per acre.	40lbs.	50lbs.	60lbs.	70lbs.	80lbs.
Mean yield per acre in bags	5.34	5.42	4.76	5.64	6.25

Calculated value of Z = —0.11487.

The low value of Z shows that the results are clearly not significant, due no doubt to the extreme heterogenity of the soil, and the trial requires repetition. It is interesting, however, to note that the yield increases steadily with the increase in rate of seeding, except for the 60 lbs. rate. Two of the four plots under this rate accounts for the break in the rise at this point.

The above results are more or less confirmed by another rate of seeding trial carried out on the Hillside Experiment Station. In this trial the highest rate of seeding, namely, 90 lbs. per acre, gave the highest yield of wheat.

International Test of Geographical Types of Lucerne.—The Branch is collaborating in this test through the Imperial Bureau of Plant Genetics, Aberystwyth, which acts in a secretarial capacity. A full progress report on the results obtained to the 14th May, 1935, was published in the journal *Imperial Bureau of Plant Genetics*: "Herbage Plants," Memorandum No. 6, November, 1935. The eight types supplied through the Herbage Bureau and a local strain of Cape Provence constitutes the types tested on the Salisbury Experiment Station.

The seed was inoculated before sowing with a culture of lucerne bacteria obtained from the Rothamstead Experimental Station. The fertiliser treatment consisted of an application of wood ashes at the rate of 9,000 lbs. per acre and superphosphate (20% P_2O_5) at the rate of 800 lbs. per acre. The

seed was sown on 5th and 6th January, 1934. From the date of sowing in January until the end of the summer rains in March, the plots were irrigated by hand, as water was required to maintain an approximate optimum moisture content in the soil. After the summer rains ceased irrigation by hand was continued until the cutting of the crop in June, when it was discontinued. Since this date no artificial water supply has been given.

The fodder yields are of most interest and are therefore recorded in this report. The green weights of all plots were taken on the same day.

Type.	Total weight of three cuttings.
Cape Provence (local type)	200¾lbs.
Grimm	166¾lbs.
Asia Minor No. 3189	166½lbs.
Provence	163½lbs.
Hungarian	147½lbs.
Turkestan No. 2578	144½lbs.
Semiryechens K	142lbs.
Turkmen No. 2528	112½lbs.
Khivian No. 2581	97lbs.

Probationary Settlement, Chilimanzi.— The writer was seconded to supervise the agricultural operations on the Unemployed Settlement at Chilimanzi in collaboration with a local committee and the Department of Internal Affairs. The opening of this Settlement coincided with the commencement of the rainy season; however, eleven married men commenced operations and were housed under canvas. A splendid and keen effort was made by the men which resulted in each preparing 20 acres of virgin granite vlei land for the cultivation of wheat in May. Immediately after the crops were established preparations were made for the erection of permanent homesteads, a school and quarters for a teacher. The men were later joined by their families and the school opened at the commencement of the last school term.

The men were established and equipped independently on separate units on holdings varying from 100 to 250 acres with a maximum of 50 acres of potential wheat soil. As far as possible the methods advocated by the Agricultural Branch were practiced. The land received a basic dressing of one ton of agricultural lime per acre and the three varieties of wheat—Kenya Governor, Quality and Gluyas—were drilled at the approximate rate of 40 lbs. per acre. A dressing of 100 lbs. of fertiliser per acre, analysing 40% $P_2 2_5$, 8 N and 12 K was applied through the drill at the time of sowing the wheat. Considering the late start made on the Settlement and the fact that the lime had very little time to exercise any really beneficial effect on the soil, the growth of the crops was highly satisfactory, attaining a height in some cases of 4 feet.

Unfortunately the crops, in common with many others in the same district, were almost completely destroyed by frost on the 17th August when in full ear, only about 40 bags being threshed, while some 600 or more were expected at that stage of growth.

In order to assist the settlers to become self-supporting as quickly as possible a variety of vegetable seeds and seed maize was issued to each family, and in addition supplies of seed potatoes, sweet potato tubers, beans, etc., were sent from the Salisbury Experiment Station. With the same object in view the settlers were supplied with breeding pens for poultry of various breeds.

Agricultural Experiment Station, Salisbury.—The following extracts are quoted from the Report by the Manager, Mr. H. C. Arnold:—

The total rainfall for the season, September, 1934, to March 31st, was 31.61 inches, which amount is equal to that of the previous season, but the incidence of the precipitation was unfavourable and the crops suffered in consequence. The first heavy rain fell on November 13th, and between that date

and January 15th a total of 20.50 inches was recorded. Hence about two-thirds of the total precipitation occured within this period of about two months. This, combined with low temperature, caused a severe check to the growth of crops such as maize, whose yields were lower than they have been for several years.

A detailed report of the experiments in progress during the season 1933-34 was published in the September issue of the *Agricultural Journal*. The continuance of this work, together with some new experiments, formed the major portion of the investigational work undertaken during the year under review.

Somerset Sunnhemp.—Free seed of this strain of sunnhemp has been issued to more than 80 farmers during the past four years. It has thus been tested in several parts of the Colony, and has given very satisfactory results. In almost every case it has proved much superior to the common kind in the production of seed, and for that reason farmers will be able to effect a considerable reduction in the cost of green-manuring their land.

Somerset Velvet Beans.—This variety has been sent to numerous farmers in many parts of the Colony, and in every case it has proved to be a hardy, drought- resistant and certain cropper.. Its seed is a valuable source of protein, and its vines provide very useful fodder which can be utilised as hay or as silage. It is believed to be the heaviest producer of protein we have among our forage crops.

Pyrethrum.—Experiments with this crop are being continued. The results so far indicate that profitable crops could possibly be grown under irrigation, and that it may be possible to develop strains which will be sufficiently resistant to the effects of our long winter drought to enable the crop to be economically produced on land which receives the natural rainfall only. Seed of promising strains found on this Station have been segregated and other strains have been obtained from Nyasaland and Kenya Colony.

Essential Oils.—Plots of three species of *Pelargonium* have been laid down with the object of testing the possibility of producing geranium oil which is largely used in the manufacture of perfumes. Preliminary extractions of oil made by the Chief Chemist's staff showed a very low oil content. Further extractions will be made to ascertain the best time for reaping the crop in order to obtain the maximum amount of oil.

Free Issues of Seed and Planting Material.

Annual Crops	426
Grass roots (issues curtailed by foot and mouth outbreak)	22
Issues to other Experiment Stations within this Colony	61
Issues to other Experiment Stations beyond our borders	119
Seed introductions	92

Straightening the Pull on the Plough.

HOW TO EASE THE BURDEN ON THE BACK OXEN.

By "B.C."

(Reprinted from *The Farmers' Weekly*, Oct. 30, 1935.)

Next time you go to the land, just give attention to the hind oxen in your plough. When the whole span, except the hind oxen are inspanned, let two or four boys hold up the hind yoke to the height of the necks of the oxen, and then let the span pull. Now judge for yourself what weight bears on the necks of the poor hind oxen.

Now watch the hind oxen closely, when inspanned, and see if they exert any strength in pulling; you will find they are carrying and not pulling. And when turning at the head-rakes, at every turn, the hind oxen have to keep the plough in the furrow for a few yards or at least a few feet, while the whole span pull on the plough in another direction.

The whole thing boiled down is this: You lift the lever so many notches to get the depth of ploughing. The hind oxen lift the head of the plough, even if it is at a certain tangent, by lifting the chain forming the line of draught or line of force or whatever you may call it, and you have to add a few notches on the lever to compensate for this, and naturally add a few pounds weight on the already over-burdened hind oxen.

Proof: When you are ploughing a certain depth, loosen the trens or coupling riem on the hind yoke and see if the plough does not go in deeper.

"That's why," somebody says, "I make the hind 'trens' so much longer." Yes, it makes the weight on the necks of

the hind oxen lighter, but the fact remains, they carry and don't pull, for if they pulled, they would still lift the chain and also step on the oxen in front.

And another thing: You force the plough in with the lever; the draught as it is tries to lift the plough out, and this results in heavier draught, and undue wear on the underside of the point of the share, and unnecessary strain on the plough, trek-chains, yokes and oxen.

Extra Chain Hitch.—Now something worth trying is this: Take an extra length of chain—say, a front chain—and hitch it on the hook of the main chain, in such a position that the overall length of the thin chain thus hooked on, is equal to the distance from the hooking place to the first ring in the main chain. Now tie the hind yoke to the ring of the extra chain with a riem or short piece of chain, fourteen to eighteen inches long according to size of oxen.

The carrying weight is thus distributed between four oxen, and is not borne by two only; furthermore, it is much less. But do this to one plough only, at the time when you fit new shares. Remember it is going to cost you 5s. 6d. extra for the extra chain.

Now when you start ploughing, don't be disheartened, because for the first day or two, you will not get your hind oxen to pull, they are accustomed to carrying and cannot realise why there is nothing to carry, and in the excitement they forget to pull. They are almost human, and it will take some time before they will realise that their owner is getting humane, and has actually spent 5s. 6d. to make things easier for them. But have patience. In a day or two they will not only realise but they will appreciate and start pulling, and, what's more, that whole span will step out, because for the colossal sum of 5s. 6d. you have acquired the pulling power of two extra oxen, and eliminated the resistance on the shares, equal to almost the carrying power of two oxen.

Saving Oxen and Shares.—But this isn't the end of the story. Keep on with the one plough only, and in a few weeks' time mark the improved condition of these two perplexed hind oxen. Then have a look at the wear of the shares and don't

be surprised if you have saved more than 5s. 6d. worth on wear of these shares only. I am not saying anything about wear on bushes, wheels and mouldboards.

Also note, that it is much easier for the hind oxen to steer the plough at the headrakes. Be careful not to make the connecting riem so long, that the hind oxen can trip over the main chain in turning.

If you have carried your experiment so far, I won't be surprised if you spend 5s. 6d. on each of your units, and not only on ploughs, but also on harrows, dam scrapers and even on implements with poles or disselbooms.

The only difference here is the hind oxen are hitched to the disselboom and the span should pull on a chain, hitched as far back as possible, under the disselboom.

Before I forget. When hind oxen get used to pulling when hitched this way, they will not pull otherwise; the span will simply force their heads into the ground.

Tobacco Auctions, Ltd.—The busy scene at the first days sales.

Soil Conservation Demonstration at Concession, May 8th, 1936.

Annual Report of the Senior Plant Pathologist

FOR THE YEAR ENDING 31st DECEMBER, 1935.

By J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist and Officer in Charge of Tobacco Research Station, Trelawney.

PART I.—PLANT PATHOLOGY.

Movements.—Visits have been paid to 97 farms in the districts of Salisbury, Lomagundi, Umtali, Umvukwes, Norton, Mazoe and Shamva, whilst the Senior Plant Pathologist spent two weeks in Beira investigating the citrus canker position, and the Assistant Plant Pathologist was engaged for a week in Concession and Darwin investigating the fungus disease of locusts. Of the visits made, 80 were of an advisory nature and 17 in the investigation of suspected "streak" disease in maize. In addition the Senior Plant Pathologist journeyed to Bulawayo to speak at the annual general meeting of the Bulawayo Horticultural and Agricultural Society.

Publications and Reports.—The following articles appeared in the February, April and October issues of the *Rhodesia Agricultural Journal*.

1. "Mycological Notes: Seasonal Notes on Tobacco Diseases. 8. The Mosiac Mystery. 9. Danger Points in Field Spraying," by Dr. J. C. F. Hopkins.

2. "Suspected 'Streak' Diseases of Maize. Notice to Growers," by Dr. J. C. F. Hopkins.

3. "The Objects and Value of Seed Treatment of Maize against Diplodia," by Dr. G. M. Wickens.

4. A Report on the Citrus Canker position in the territory of the Mocambique Company was submitted by the Senior Plant Pathologist.

General. Unusual weather conditions at the commencement of the year favoured the development of diseases in most cultivated plants. Almost continual rain and low temperatures during December and January had a serious effect upon the young tobacco and maize crops, which were severely attacked by leaf spotting and seedling blight organisms respectively, whilst an abnormally large number of reports were received of root and stem diseases of garden plants. Early blight (*Alternaria solani*) soon appeared on the first potato plantings, which generally escape this disease, and tomatoes were badly affected by leaf spot (*Septoria lycopersici*) and fruit rots. Mildews were also prevalent on orchard crops and strawberries.

The conditions which favoured disease among crops were apparently responsible for a widespread epidemic of the locust fungus (*Empusa grylli*). Large numbers of dead infected insects were received from many parts of the territory and the locust menace for the year disappeared before the middle of the crop season.

Probably on account of the unusual rains further interest in fungicides was shown by the agricultural community and larger amounts of spray materials and equipment were stocked by merchants.

Further enquiries were received regarding the preparation of home-made bordeaux mixture, and it appears that an increasing number of farmers are preparing their own spray fluids. This is due in part to the saving in cost effected, but is also probably influenced by the fact that proprietary fungicides are sometimes received on the farm in such condition that it is not possible to make correct bordeaux mixture from them. In the case of the ready mixed powders, which not infrequently become compacted to a solid lump in the package, the fault probably lies with the manufacturer, who exports the material in sacks or paper bags instead of in waterproof containers. With a small agricultural community such as exists in Rhodesia, it is difficult for the merchants to estimate accurately what stocks should be imported. A certain amount of old stock is, therefore, sold each season, with consequent dissatisfaction to the grower who is unlucky enough to receive material which has been exposed to damp air.

Material which has been thus affected no longer agrees with the specifications stated on the packages by the manufacturers, and in the case of bordeaux mixture especially, has not the same chemical composition. If the practice of selling deteriorated fungicidal materials continues, it would appear to be advisable for an investigation to be made into the legality of the procedure.

It is gratifying to be able to report a continuation of the increased interest in fungicides, but full benefit from the use of sprays is unlikely to be realised for many years to come in the absence of assistance from a field extension service.

The 1936-37 season has so far been characterised by a severe drought, so that planting has been delayed and no diseases of note have been reported.

Routine.—The routine duties of the laboratory have been carried out principally by the Assistant Plant Pathologist who, as the year progressed, has taken over more and more of the advisory work, which has been almost entirely in his hands since the transfer of the Senior Plant Pathologist to the Tobacco Research Station, Trelawney.

Two hundred and forty-nine specimens of plant diseases have been examined, of which 140 were sent in for advice on control measures, and the remainder collected. Forty-six diseases, new to the Colony, have been recorded, and 74 specimens added to the herbarium. The decrease, as against last year, of the number of specimens received is accounted for by a reduction in the amount of tobacco material which it is customary to receive, due presumably to an increased knowledge of the various diseases and a greater appreciation of the necessity of applying adequate routine control methods in a season particularly favourable to the development and spread of diseases.

The remaining specimens comprised a wide variety of farm crops, timber and ornamental trees, plants of the orchard, market garden and flower garden, together with a few of the indigenous flora.

Reports were furnished on tobacco material for the Mycologist, Tanganyika Territory, and Dr. C. W. B. Arnold, Research Officer to the Imperial Tobacco Company, Nyasaland.

A large number of samples of dead and dying locusts has been examined for the presence or absence of the locust fungus, *Empusa grylli*.

A number of cultures of soya bean nodule bacteria were prepared and distributed to farmers, in order to demonstrate the value of seed inoculation and to acquaint farmers with the method.

New and interesting records include:—Leaf spot of Antirrhinum (*Phyllosticta antirrhini*), leaf spot of *Phoenix reclinata* (*Exosporium palmivorum*), leaf spot of Begonia (*Phyllosticta begoniae*), leaf spot of *Asplenium* sp. (*Phyllosticta asplenii*), rust of cultivated geranium (*Puccinia pelargonii-zonalis*), dry rot of potato (*Fusarium coeruleum*), root rot of pansies (*Rhizoctonia solani*), root rot of apple, plum, and cherry (*Armillaria mellea*), charcoal rot of sweet potato (*Rhizoctonia bataticola*) (*Macrophomina phaseoli*), and mildews (*Oidium* spp.), of poppy, *Vernonia amygdalina*, and *Senecio latifolius*.

Research.—Continuing the investigation of the leaf curl type of disease found in a wild species of *Sida* and recorded in the 1933 Annual Report, further attempts were made to transmit the affection to susceptible varieties of cotton by means of budding, grafting and insect vectors. Two species of white flies commonly found in the Colony were tested, but no transmission was affected. Similar failure attended the other methods.

Successful transmission was, however, obtained from diseased to healthy *Sida* by means of both budding and grafting, but not by means of white flies. It now appears to be almost certain that the disease is caused by a virus, and further work is planned with tobacco and cotton.

Owing to the demands of his duties in connection with the Tobacco Research Station, Trelawney, the Senior Plant Pathologist has been able to devote little time to phytopathological research. The Assistant Plant Pathologist, Dr. G. M.

Wickens, however, reports as follows:—"The following are the more important investigations carried on during the past year."

"*Tobacco.*—A leaf disease of tobacco, characterised by the appearance of small round, brownish or white spots on mature leaves of well-developed plants, was somewhat prevalent during the 1934-35 season. While a species of *Phyllosticta* was usually present in the dead tissues of larger spots, small spots were invariably found to be sterile. It is suspected that the disease is of virus origin, although no transmission was effected by juice inoculation to seedlings. Material was sent to Dr. Kenneth M. Smith, of Cambridge, England, who stated that it is very similar to a virus disease that occurs in France and does not appear to be sap-inoculable. Further experiments are contemplated."

"*Maize.*—In the 1934-35 season a severe outbreak of disease, exactly similar in its symptoms to a virus disease known as 'Streak' in other parts of Africa, occurred locally in the Umtali district causing appreciably reduced yields. A similar disease was also reported or observed from Glendale, Salisbury, and Gutu."

"Investigations into this disease, in collaboration with the Entomological Branch, have followed two lines, firstly, a search for the insect by which it is spread (assuming, as appears almost certain, that it is an insect-transmitted virus disease), and secondly, an attempt to discover whether environmental conditions have any appreciable controlling action on its occurrence. Large numbers of jassids and fulgorids (a jassid and a fulgorid both carry a similar disease in East Africa) have been collected from infected maize lands and then fed on healthy seedlings, but so far with only negative results. These experiments are being continued."

'A survey of the occurrence of the disease on a number of farms in the Umtali district yielded the interesting fact that while one farm may have almost 100 per cent. infection, another only a few miles away, may be free from the disease.

From observations made, tentative conclusions have been drawn regarding the influence of environment on the incidence of the disease, but a definite statement would be premature."

"An experiment on the relative efficacy of a number of fungicidal dusts in controlling seedling blight of maize in poor samples of seed was briefly reported on in the *Rhodesia Agricultural Journal*. The sample of seed used was appreciably poorer than the average, and seed treatment caused an unexpected reduction in stand, but nevertheless a somewhat increased yield. This result raises a number of important questions, which are the subject of further enquiry."

"*The Locust Fungus.*—During the past year heavy mortality has occurred in locusts of all ages as a result of infection by *Empusa grylli*. It is not inconceivable that, with greater knowledge of the disease and the discovery of a method of artificially cultivating the fungus, mankind would have a powerful weapon in the fight against locusts."

"A number of attempts have been made to infect locusts and to grow the fungus *in vitro*, but so far without success. The experiments have, however, resulted in the evolution of an improved technique, and yielded a starting-off point for critical work."

"Other subjects of investigation include a crown-rot disease of lucerne, associated with *Rhizoctonia lamellifera* and *Fusarium* spp., which caused heavy mortality among a large number of varieties grown for an International test at Salisbury Experiment Station, and 'damping off' of pine seedlings."

Crops.—*Tobacco.*—The 1934-35 season was distinctly unfavourable for the growth of tobacco and consequently a good deal of damage to the crop was caused by physiological diseases, occasioned by excessive rain followed by drought. In the early part of the season continuous rainfall was experienced for days on end, and rain fell almost every day from the middle of December until the middle of January.

Sunshine was very scarce and soil and air temperatures low. The crop made little growth during this period and on nearly all farms frog eye (*Cercospora nicotianae*) became well established on the lower leaves of all plants. When dry conditions were again established it was found that most of the crop was affected by nitrogen deficiency, so that the majority of the lower leaves perished. The remainder, being chlorotic, were soon attacked by frog eye. In some districts very little precipitation occurred after the end of January, and plants ripened early, yielding both light and spotted leaf. Where late rains were experienced and adequate priming of diseased leaves carried out, reasonably clean crops were obtained.

The slow development of the crop in the early part of the season was responsible for an abnormally high infection by mosiac. On a number of farms the plants were primed as a precaution against frog eye before many leaves had been put out and mosiac symptoms had appeared. Thus healthy and diseased tobacco was handled indiscriminately and the virus transmitted from plant to plant.

Probably as a consequence of excessive rains, an increased number of growers experimented with spraying in the field. Various types of equipment were evolved, including both hand pumps and wheeled outfits. Reports obtained of disease control were extremely divergent, ranging from hilarious success to complete failure. In the majority of instances investigated, failure could be traced to misunderstanding of the object of field spraying or to not following instructions issued by the Plant Pathology branch.

Common faults observed on a good number of farms included incorrect mixing of bordeaux mixture and use of agricultural or air-slaked lime instead of best quicklime; use of deteriorated proprietary powders; omission of spreader from the spray fluid; the use of limewashing nozzles in place of those with small orifices; preparation of the spray fluid at double or treble strength; using up the residue of bordeaux mixture left over from a previous spraying; the application of an excessive amount of spray fluid, and many minor inaccuracies.

These faults have been brought to the notice of farmers by means of lectures and articles in the *Rhodesia Agricultural Journal* and the Press, and improvements in methods have already been seen in the 1936-37 season.

Maize.—Cob rot of maize, caused by a number of fungi grouped for convenience under the heading "Diplodia" is still prevalent. Over and above the direct loss of crop caused by obviously mouldy cobs, there occurs a high degree of seed infection. All samples of farm-selected seed examined have contained a large proportion of more or less infected seeds, which produce an inferior stand and many unthrifty seedlings. There is still room for a much greater appreciation, among farmers generally, of the losses occasioned by the practice of leaving old, infected maize stalks, husks and cobs lying around the farm, and of the necessity of burning all such trash in order to produce a cleaner crop and healthier seed.

Deciduous and Soft Fruits.—Severe infection by mildew has occurred in strawberry beds and apple orchards during the year. Every case of apple mildew examined was on a tree that had been given no more than the one dormant winter spray. It seems to be not generally realised by fruitgrowers the the fungus passes the winter not only on the twigs, but also within the bud leaves and scales, where it is unaffected by the winter spray. Without the application of sprays during and after the unfolding of the leaves, no satisfactory control of mildew can be expected. The grower who wishes to raise a commercial crop annually must be prepared to carry out as routine a spray schedule involving three, four or even five applications every year.

The mildews generally are not unduly difficult to prevent with correct treatment, but once established are very hard to eradicate. The severe attacks of strawberry mildew appear to have arisen from failure to apply control measures until the fungus becomes visible and is well established.

Other Crops.—Judging from the numbers of specimens sent in, the following diseases appear to have been somewhat prevalent: "spraing" of potatoes and blossom-end rot of tomatoes. For all of these good cultivation and adequate manuring—in short, good farming—is the cure.

Miscellaneous.—The usual exhibit was placed on the Salisbury Agricultural Show—special exhibits dealing with mosiac in tobacco and "Diplodia" in maize.

Thanks are tendered to the following mycologists who have assisted this branch:—Dr. K. M. Smith, for reports on a suspected new virus disease of tobacco; Dr. H. H. Storey, for (i.) notes on "streak" disease of maize and specimens of the insect vector, (ii.) information on virus diseases of the leaf curl type; Dr. E. M. Doidge for determinations; Dr. J. A. Marchionatto for cultures of fungi parasitic on locusts; and Mrs. E. M. Laughton, for notes on the cultivation of the locust fungus, *E. grylli.*

His Excellency the Governor, accompanied by the Hon. the Minister of Agriculture and Capt. L. Holbech, paid a visit of inspection to the laboratory.

The Supplementary Feeding of Mineral and Protein Supplements

TO GROWING CATTLE IN SOUTHERN RHODESIA AND ITS RELATION TO THE PRODUCTION OF BEEF STEERS.

By

C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate.

A. E. Romyn, Ph.D., Chief Animal Husbandry Officer, Department of Agriculture, Southern Rhodesia.

D. G. Haylett, Ph.D., Director, Rhodes Matopo Estate.*

F. Ericksen, Dip. Agric., Experimentalist.

In Southern Rhodesia, as in other parts of South Africa, cattle confined to veld grazing only fall off in condition very considerably during the winter months. In parts where the pastures are over-stocked, such as in Native Reserves and on badly managed farms, the cause of this loss in condition is probably more quantitive than qualitative. In other words, the cattle are semi-starved. In other parts again where there is a sufficiency of grazing the problem is qualitative.

The quality of the pasture during the winter months varies considerably in different parts of the country. The best grazing is usually found in the low veld, *i.e.*, in the low lying parts of the country (under 3,000 feet) where the annual rainfall varies between 10 and 15 inches. On the high veld again (5,000 feet and over) with a rainfall of 25 inches and over, the winter grazing is of extremely poor quality, except where the grazing is properly controlled by using not too large paddocks and making use, before the rains, of early vlei grazing where available.

Experience shows that the winter condition of the cattle varies in the same way as the quality of the pastures. On

*Since resigned.

the high veld cattle start losing condition as early as March, April or May, whereas this may only happen in June, July and August in the low veld.

All cattle are affected adversely by the poor quality of the winter grazing, but young growing stock and pregnant and/or lactating females definitely suffer most.

This annual set-back during the winter months is, no doubt, to a large extent, responsible for the slow rate of maturity of all range cattle and the deterioration of improved cattle so often seen, heard of and spoken about in South Africa.

As Southern Rhodesia is essentially a livestock country, disposing of her chilled beef in the United Kingdom, the early maturity, good type and quality of its cattle are of major importance.

The work of Theiler, du Toit, Green, Malan, Bisschop and others (11) in South Africa, of Orr and Holm (10) in Kenya and of other research workers in America, Australia, New Zealand and other parts of the world (11), suggested that the pastures in this Colony may be deficient in certain minerals, especially phosphorus, sodium and chlorine. Pasture analyses, both here and in the Union of South Africa (3) suggested a possible protein deficiency.

Object of the Experiment.—This was to determine whether the feeding of phosphorus, sodium, chlorine and protein supplements to young grazing cattle under our conditions would produce favourable results as measured by increased weight and condition of the animals.

Experimental Animals.—Forty uniform, well bred Lincoln Red Shorthorn yearling steers (weaners) were purchased nearby off similar grazing. They were born during the months of November and December, 1930, and January, 1931, and varied in age from 16 to 18 months at the commencement of the experiment on the 18th May, 1932.

Records Kept.—At the commencement of the trial and thereafter at 28 days' intervals, the animals were weighed individually. On each occasion they were weighed on three consecutive days and the average of the three weights taken as the weights on the second day.

At different periods blood samples of all the animals in Groups I. and II. were analysed for inorganic phosphorus.

Detailed observations on the health, etc., of the animals were also kept throughout.

Groups.—The forty weaners were divided into four similar groups of 10 per group.

The four groups received the following rations:—

Group I.—Veld grazing only (control).

Group II.—Veld grazing plus $\frac{2}{3}$ oz. dicalcium phosphate ($CaHPO_4$) per day.(*)

Group III.—Veld grazing plus 1 oz. Liverpool salt (sodium chloride) each per day.

Group IV.—Veld grazing plus 1 to 1½ lbs. of ground nut cake (45% crude protein) each per day.

Management and Feeding.- Throughout the experiment the four groups were grazed together and they had an unlimited amount of grazing available. They grazed on the sandveld(**) where the grazing, especially at this Institution, is known to be of extremely poor quality during the winter months.

Every morning, except Sundays, they were all collected in the paddock at the crush pens, and Groups II. and III. hand fed individually their respective rations. After feeding they were immediately turned out to graze. During the winter months, as soon as the animals commenced loosing condition, the feeding of ground nut cake was commenced. This supplement was fed individually to the animals in Group IV.

The crush and feeding pens were in the centre of the paddock where the animals grazed. This reduced driving during the daily collection for feeding to a minimum.

RESULTS.

Pasture Analyses.—The data available on the composition of the pastures on the sandveld at this Institution and from hay made from the same grasses are given below in Table I.

*According to du Toit and Green ([4]) 2/3 oz. dicalcium phosphate satisfies the phosphorus requirements of grazing cattle in Bechuanaland and is equivalent to 2 or 3 ozs. bonemeal.

**The land overlying the granite formation is usually described as "Sandveld."

TABLE I.

Results expressed in percentages of dry matter.*

PASTURE.

Month.	Crude Protein.	Acid Soluble Ash.	CaO.	P_2O_5.	Na2O.	Cl.
November...	4.0	2.2	.51	.32	.23	.16
December...	11.2	2.3	.55	.25	.25	.14
January	8.0	4.2	.54	.40	.29	.43
February	7.4	3.0	.33	.31	.19	.21
March	6.1	3.0	.40	.34	.29	.17
April	—	2.4	.37	.38	.26	.16
May	3.7	2.0	.54	.28	.23	.16
June	3.1	2.3	.36	.23	.27	.14
July	3.3	2.1	.46	.31	.22	.16
August	2.9	2.1	.51	.24	.25	.16
September	3.1	1.8	.39	.23	.32	.17
October	1.9	—	—	—	—	—
		HAY.				
February, 1931 ...			.32	.18	.23	.22
February, 1932 ...			.37	.26	.19	.24
February, 1933 ...			.28	.30	.26	.29

These data seem to indicate that according to generally accepted standards ([2], [6], [11]) young animals ingesting 10 to 15 lbs. of dry matter per day would not receive sufficient phosphorus or chlorine throughout the year or protein during the winter months and that there is a possibility that the sodium would also not be sufficient. With the probability, therefore, that the protein and these minerals were deficient

*The samples from which the crude protein was determined were taken during the period November, 1932, to October, 1933, in the paddocks where the cattle actually grazed. The mineral analyses were kindly supplied by the Chief Chemist. These were from samples taken from similar but *adjoining* grazing during the year 1931 and from hay samples taken during February, 1931, 1932 and 1933.

in the grazing it was decided to determine the effect of feeding protein, phosphorus, sodium and chlorine supplements to growing cattle grazing on these pastures

It should be pointed out, however, that the paddocks in which they grazed contained numerous indigenous trees and shrubs the leaves and pods of some of which the animals ate quite freely which might considerably have modified the intake of the protein and minerals.

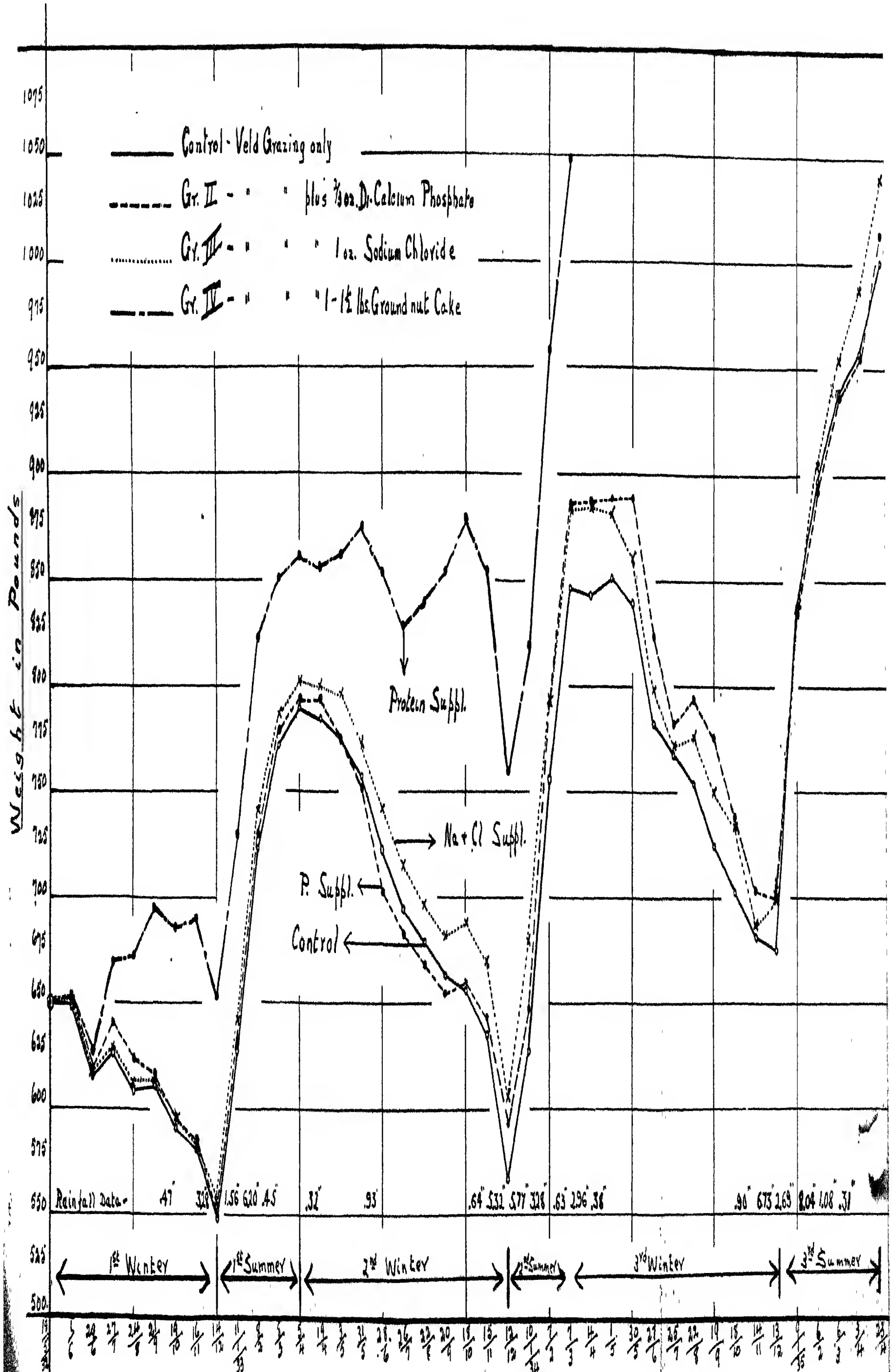
Growth Data.—Table II. gives the average monthly weights of the four groups of steers during the period 18.5.1932 to 24.4.1935, *i.e.*, for a period of nearly three years.

TABLE II.

Average Monthly Weights of Four Groups of Steers.

	Date.	Group I. Control veld grazing.	Group II. Phosphorus 2/3 oz. CaHPO4.	Group III. Sodium and Chlorine 1 oz. NaCl.	Group IV. Protein 1-1½ lbs. ground nut cake.
		Wieght lbs.	Weight lbs.	Weight lbs.	Weight lbs.
1st Winter.	18. 5.32	650	651	648	649
	1. 6.32	648	654	651	654
	29. 6.32	615	619	617	626
	27. 7.32	626	641	628	670
	24. 8.32	608	624	612	672
	21. 9.32	611	618	612	696
	19.10.32	591	595	595	685
	16.11.32	581	585	583	690
	14.12.32	547	548	554	653
1st Summer.	11. 1.33	627	630	643	730
	8. 2.33	724	729	743	822
	8. 3.33	773	779	787	851
	5. 4.33	790	794	803	861

	Date.	Group I. Control veld grazing.	Group II. Phosphorus 2/3 oz. CaHPO4.	Group III. Sodium and Chlorine 1 oz. NaCl.	Group IV. Protein 1-11 lbs. ground nut cake.
		Wieght lbs.	Weight lbs.	Weight lbs.	Weight lbs.
2nd Winter.	19. 4.33	785	794	799	856
	3. 5.33	774	776	796	862
	31. 5.33	758	751	773	876
	28. 6.33	723	703	743	854
	26. 7.33	695	682	715	829
	22. 8.33	681	669	697	840
	20. 9.33	664	655	682	854
	18.10.33	657	661	689	880
	15.11.33	636	645	670	855
	12.12.33	568	594	606	760
2nd Summer.	10. 1.34	627	649	680	820
	7. 2.34	757	792	793	959
	7. 3.34	847	887	885	1050
3rd Winter.	4. 4.34	845	889	886	
	1. 5.34	853	889	881	
	30. 5.34	840	890	861	
	27. 6.34	782	825	799	
	25. 7.34	769	783	773	
	22. 8.34	756	795	776	
	19. 9.34	726	776	750	
	18.10.34	704	739	734	
	14.11.34	682	704	688	
	13.12.34	676	700	700	
3rd Summer.	9. 1.35	837	835	838	
	6. 2.35	899	894	906	
	6. 3.35	940	939	955	
	3. 4.35	958	957	987	
	23. 4.35	1003	1016	1041	



Weight in Pounds
Control - Veld Grazing only
Gr. II - " " plus 7/8 oz. Di-Calcium Phosphate
Gr. III - " " " 1 oz. Sodium Chloride
Gr. IV - " " " 1-1½ lbs. Ground nut Cake
Protein Suppl.
Na + Cl Suppl.
P. Suppl.
Control
Rainfall Data -
1st Winter
1st Summer
2nd Winter
2nd Summer
3rd Winter
3rd Summer

These data are summarised in Table III. and illustrated very strikingly in Figure I. In Figure I. particulars of the rainfall during the course of the experiments are also given.

TABLE III.

Summary and Statistical Analysis of Growth Data.

Date.	Stage.	Group I. (Control). Average live weight and S.E of Mean(†).	Group II. (Phosphorus Supplement.) Average live weight and S.E. of Mean.	Group II. (Phosphorus Supplement.) Average gain or loss over Control and S.E. of difference(‡).
		lbs.	lbs.	lbs.
A—18.5.32.	Commencement ...	650 * 23	651 * 17	+ 1 * 29
B—14.12.32.	End 1st winter	547 * 19	548 * 15	+ 1 * 24
C—5.4.33.	End 1st summer ...	790 * 25	794 * 21	+ 4 * 33
D—12.12.33.	End 2nd winter	568 * 17	594 * 6	+26 * 18
E—7.3.34.	End 2nd summer ...	847 * 29	887 * 13	+40 * 32
F—13.12.34.	End 3rd winter...	676 * 28	700 * 11	+24 * 30
G—23.4.35.	End 3rd summer	1003 * 35	1016 * 12	+13 * 37

Date.	Stage.	Group III. (Sodium and Chlorine Supplement). Averagt live weight and S.E. of Mean.	Group III. (Sodium and Chlorine Supplement). Average gain or loss over Control and S.E. of difference.	Group IV. (Protein Supplement). Averagt live weight and S.E. of Mean.	Group IV. (Protein Supplement). Average gain or loss over Control and S.E. of difference.
		lbs.	lbs.	lbs.	lbs.
A—18.5.32.	Commencement	648 * 21	— 2 * 31	649 * 19	— 1 * 30
B—14.12.32.	End 1st winter	554 * 16	+ 7 * 25	653 * 20	**+106 * 28**
C—5.4.33.	End 1st summer...	803 * 19	+13 * 31	861 * 26	**+ 71 * 36**
D—12.12.33.	End 2nd winter	606 * 15	+38 * 23	760 * 29	**+192 * 34**
E—7.3.34	End 2nd summer...	835 * 25	+38 * 38	1050 * 38	**+203 * 48**
F—13.12.34.	End 3rd winter	700 * 25	+24 * 36		
G—23.4.35.	End 3rd summer	1041 * 36	+38 * 50		

*Represents plus or minus.

(†) S.E. of the Mean from formula S.E.m = square root of $\left(\frac{S.f.d.^2}{n(n-1).}\right)$

(‡) S.E. of the difference from formula S.E.d. = square root of $\left(S.E.m._1^2 + S.E.m_2^2\right)$

Significant differences are given in black type.

DISCUSSION.

The experiment reported on should be considered as of a preliminary nature. The purpose of this report is to present the data in such a way as to be of interest to the farmer also. For this reason a paper of a more technical nature is not presented.

EFFECTS OF DIFFERENT SUPPLEMENTS ON THE GROWTH OF ANIMALS IN GROUPS II., III. AND IV.

For the sake of convenience the effect of each supplement will be discussed separately.

Phophorus.—From Table II. and Figure 1 it appears very clearly that there was very little difference in rate of growth between the control group (Group I.) and the phosphorus fed group (Group II.). It is of interest to note that this was the case during the summer months as well as during the winter months. At the end of each winter the phosphorus fed animals had lost as much weight and were in as poor and emaciated condition as the control ones—see figures 2 and 3. In Group I. two animals and in Group II. one actually died from weakness just after the commencement of the rains during the scouring period.

Although there were at times small differences in weight between the two groups it will be seen from Table III. that these differences were statistically *not* significant and so cannot be ascribed to the dicalcium phosphate fed.

Both groups (I. and II.) were ready for finishing off on April 23rd, 1935, when they were 4 years and 4 months old and weighed on the average of 1,003 and 1,016 lbs. respectively. They were ready for export after four months' feeding when 4 years and 8 months old.

The growth data show, therefore, quite definitely that under these conditions the feeding of the phosphorus supplement had no effect on the growth of the animals.

To get more information on the phosphorus intake of the animals all those in Groups I. and II. were bled at

different intervals, and the blood analysed for inorganic phosphorus according to the method of Green(6) as modified by Malan and v.d. Lingen(9).

The work of Malan, Green and du Toit(8), Malan(7) and du Toit, Malan and others(3) at Onderstepoort has shown a direct relation between the phosphorus intake and blood phosphorus (inorganic fraction) of livestock, and they have come to the conclusion that the I.P.(*) content of the blood of a number of animals (not less than 10) gives a very good indication as to whether the animals are suffering from a phosphorus deficiency or not.

These workers suggest the following I.P. levels as indicative of a phosphorus deficiency or sufficiency in the grazing:—

	High I.P. m.gm. P. per 100 c.c. blood.	Low I.P. m.gm. P per 100 c.c. blood.
Mature stock	3.8 and over	under 3.8
Young cattle	5.3 and over	under 5.3

The results of the blood analyses are set out in Table IV.

TABLE IV.—GROUPS I. AND II.

	Group I. Control.	Group II. Phosphorus Supplement.	Gain or Loss over Control.
17.11.32	5.11	5.41	+0.30
10. 1.33	5.42	5.75	+0.33
8. 2.33	5.42	5.75	+0.33
22. 4.33	4.47	5.78	+1.31
22. 7.33	4.82	5.68	+0.86
18. 9.33	4.76	5.02	+0.26
Average	5.00	5.57	+0.57

It is very clear from Table IV. that the feeding of the phosphorus supplement definitely produced an increase in inorganic blood phosphorus in Group II. The increase was statistically significant.

(*) I.P.—abbreviation for inorganic phosphorus.

It is further evident that during the dry winter months the I.P. contents of the blood was on the whole lower than during the summer months. This was naturally due to the fact that the phosphorus content of the grazing is lowest during the dry months of the year.

Although the I.P. values obtained for Group II. were definitely higher than those for Group I., the latter are all considered to fall within normal limits and in no way indicative of a phosphorus deficiency. These values are also nowhere near the very low figures (2.3 m.gm. per 100 c.c. blood) obtained by Malan, Green and du Toit(8) at Armoedsvlakte, where cattle actually suffer from osteophagia and styfsiekte, a disease due to phosphorus deficiency. At this Institution neither of these have been noted.

The fact that the feeding of the phosphorus supplement to Group II. increased its inorganic blood phosphorus above that of Group I. appears, therefore, to be no indication that Group I. suffered from a phosphorus deficiency.

Similar results were obtained in Nigeria by Anderson(1). He found that although the feeding of steamed bone flour to young cattle increased the inorganic blood phosphorus from 4.8 to 6.0 m.gm. per 100 c.c. it had no effect on the rate of growth of the cattle.

Conclusion.—From the data presented it appears safe to conclude that the sandveld pastures (including an undetermined amount of trees and shrubs ingested) at this Institution supply a sufficiency of phosphorus to satisfy the requirements of young growing cattle maturing at the rate of the cattle in this experiment.

The feeding of bonemeal, dicalcium phosphate and other phosphorus supplements to young growing cattle is, therefore, not necessary (*).

Sodium and Chlorine (Salt).—From a careful study of Table II. and figure 1 it appears that there was very little difference in growth between the animals in the control group

*Similar results have since been obtained in subsequent experiments which are being prepared for publication.

(Group I.) and those in the salt fed group (Group III.). This was the case throughout the experiment, although there were at times slight differences in weight between the two groups.

Table III. shows further that the differences that did exist were never significant. In other words, they were due to chance and not to the salt supplement fed.

The Group III. steers, like Group I., were considered ready for finishing off on the 23.4.35 when their average weight was 1,041 lbs. They were then 4 years 4 months old and when exported after 122 days' feeding were 4 years 8 months of age.

As was the case with the phosphorus fed animals (Group II.) the salt fed ones (Group III.) did no better as regards weight increase or decrease during the winter months than the control animals (Group I.). In Group III. two actually died from weakness during the scouring period.

Only at one time during the three year duration of the experiment was there any *noticeable* difference between Groups I. and III. This difference was noticed at the end of the first winter on the 14th December, 1932, when the Group III. animals, although just as thin and emaciated as those in Group I., had a slightly more sleek appearance. See figure 2.

Conclusion.—From the data presented it is clear that the Group III. animals did not benefit as regards weight increase from the feeding of the salt supplement, and we conclude, therefore, that the grazing, including browse, supplied a sufficiency of both sodium and chlorine for cattle maturing at the rates these did. The suspicion that the grazing was deficient in these two minerals was, therefore, not confirmed.

Work to confirm these results is at present in progress.

Protein.—As pointed out previously, the ground nut cake was fed to the Group IV. animals during the dry months only. Feeding was commenced as soon as the animals started losing condition.

Table IV. gives particulars of the amount of cake fed during the experiment.

TABLE IV.

Consumption of ground nut cake by steers in Group IV. during the two winters—1.6.32 to 14.12.32 and 21.4.33 to 12.12.33.

	Total amount fed(*).	Fed daily.	No. of days fed.	Fed during winter. Total.	Aver. per day during winter.
	lbs.	lbs.	lbs.	lbs.	lbs
1. 6—20.10.32 . .	122	1	122	—	—
21.10—12.12.33 . .	47	$1\frac{1}{4}$	59	181	1.1
21. 4—30. 7.33 . .	86	1	86	—	—
31. 7—12.12.33 . .	116	$1\frac{1}{2}$	174	260	1.3

The effects the feeding of the ground nut cake had on the animals in Group IV. require a fairly detailed discussion.

From Table IV. it will be seen that during the first winter the steers received on the average a total of 181 lbs. of cake each, *i.e.*, 1.1 lbs. per day. From June 1st to October 20th, 1932, they actually received 1 lb. daily and from October 21st to December 14th, 1932, $1\frac{1}{4}$ lbs. daily.

Whereas there was no difference in weight between the Group I. (control) and Group IV. (ground nut cake) steers at the commencement of the experiment on May 18th, 1932, the difference between the two groups at the end of the first winter on December 14th, 1932, was simply astounding (see Table II. and figure 1).

During this period the control animals (Group I.) had actually lost on the average 103 lbs. each. This should be considered an enormous loss on yearling animals. All the animals in this group were thin and emaciated and just managed to pull through after the rains. They looked very much like the average run of cattle seen in the Colony at the end of each winter (see figure 2).

Group IV. (ground nut fed), however, presented a very different picture. On November 16th, 1932, *i.e.*, six months

*Excluding Sundays.

after the commencement of the experiment, they had actually gained 40 lbs. in weight. This gain they lost just after the commencement of the rains when, like the other groups, the green grass caused them to scour very badly. However, at the end of the first winter, on December 14th, 1932, when Group I. weighed on the average 103 lbs. less than they did at the commencement of the experiment, Group IV. had maintained their initial weights in spite of the 40 lbs. loss they had sustained as a result of scouring.

At the end of the first winter Group IV., therefore, actually weighed on the average 106 lbs. more than Group I.

It is only the man with practical experience than can visualise the enormous difference in appearance there was between Groups I. and IV. (see figure 2).

Table II. shows that this difference in weight between the two groups was statistically significant—in other words, it was due to the ground nut cake fed and no other cause.

After December 14th, 1932, when there was a plentiful supply of young green grass available, both groups made exceptionally good gains. In some cases individual animals put on up to 5 lbs. per day. During this first summer (14.12.32 to 5.4.33) the Group I. animals gained on the average 243 lbs. each, but after making up the weight they lost during the previous winter the actual net gain for the period 18.5.32 to 5.4.33 was only 140 lbs.

During the same period (14.12.32 to 5.4.33) Group IV. gained on the average a total of 208 lbs., or approximately 35 lbs. *less* than the *total* gain (243 lbs.) or 68 lbs. more than the average net gain of Group I. The better condition of the Group IV. animals at the commencement of the summer was, no doubt, responsible for the slightly smaller total gains made by them during the summer months. However, at the end of the first summer (5.4.33) Group IV. was still on the average 71 lbs. heavier than Group I., and as they had started the summer in good condition they were in *very* much better condition at this time than the other three groups. Even a layman could very easily pick them out from amongst the other animals.

It is of particular interest to note here that the cattle in Group I. put on weight for four months only, *i.e.*, from December 14th, 1932, to April 5th, 1933.

During the second winter (5.4.33 to 12.12.33) the Group I. steers lost considerably in weight—an average of 222 lbs. each—and, therefore, weighed only 568 lbs. at the end of it on the 12.12.33. This means that they weighed actually 82 lbs. *less* than they did eighteen months previously at the commencement of the experiment.

All the animals in this group were thinner and more emaciated than they were at the end of the first winter (14.12.32). This was, no doubt, due to the fact that the 1932/33 rainy season was most unsatisfactory both as regards total rainfall and distribution. Effective rains actually stopped before the end of January, 1933, and the result was a longer and worse dry season than usual. Some of the animals were so weak that they had to be picked up daily during the scouring period and two animals actually died from weakness (see figure 3).

With Group IV. the position was again, as during the first winter, very different.

During this winter they received on an average a total of 260 lbs. of cake each, *i.e.*, 1.3 lbs. per day. From April 21st to July 30th they actually received 1 lb. daily, and from July 31st to December 12th, 1933, 1½ lbs. daily.

During the first seven and a half months (5.4.33 to 15.11.33) of this dry season they had actually maintained the weight they had reached at the end of the previous summer on the 5th April, 1933. After the rains this group, as the other groups, scoured badly and lost on the average 95 lbs. in weight. However, at the end of this winter, on the 12th December, 1933, Group IV. was still 192 lbs. heavier than Group I.

At this time the Group IV. steers still looked sleek and thrifty and were very much bigger and better grown than those in Group I. Figure 3 shows this very clearly.

Table III. shows that this enormous difference in weight between Group IV. and Group I. was also statistically significant, *i.e.*, it was due to the ground nut cake fed and *not* to chance.

It is of interest to note that Group IV. lost in weight during the eight weeks 31.5.33 to 26.7.33. Up to this time they were still receiving 1 lb. of peanut cake daily. This was increased to 1½ lbs. per day on the 31st July, 1933, and there was an immediate increase in weight again.

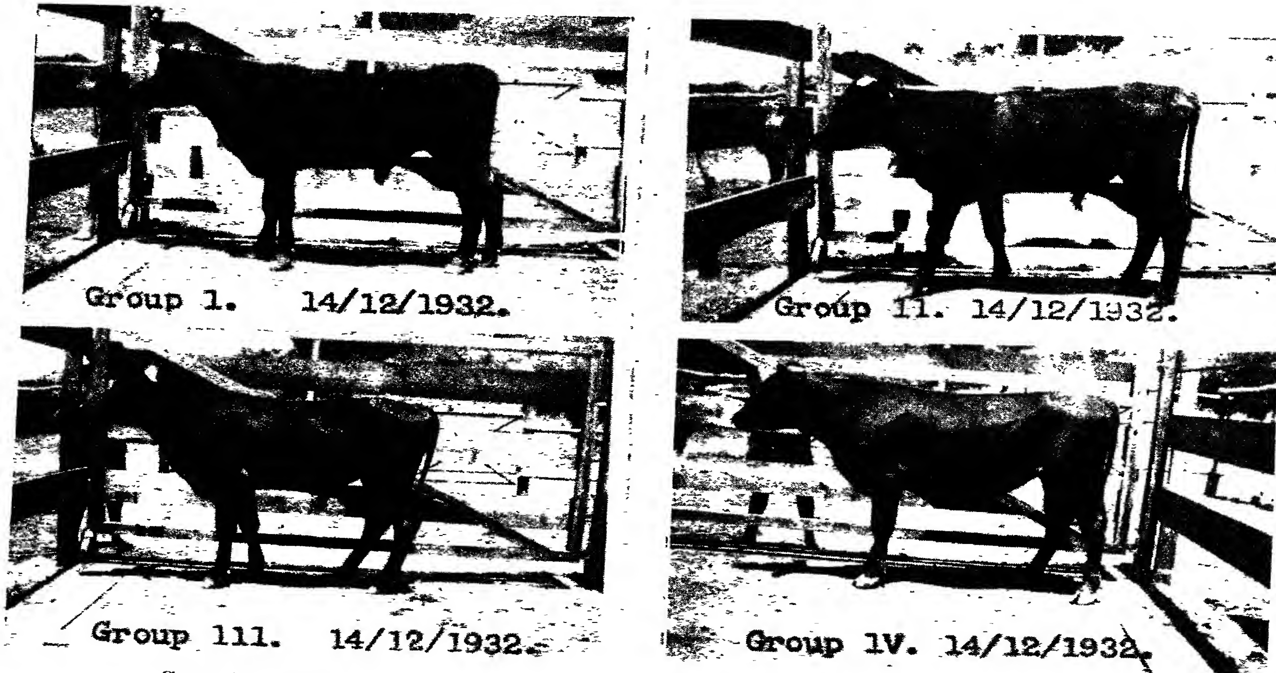
With the commencement of the new grazing season (12.12.33) both groups again did exceptionally well. The period during which the animals actually gained in weight was only three months—12.12.33 to 7.3.34. During this period Groups I. and IV. gained on the average 279 and 290 lbs. respectively, and so reaching the average weights of 847 and 1,050 lbs. respectively.

Although the total gains made by Group I. during the three summer months should be considered exceptionally good, the fact remains that their net gains over the twelve months 5.4.33 to 7.3.34, after deducting what they lost during the previous winter (5.4.33 to 12.12.33) was only 57 lbs. Again Table III. shows that the difference in weight between the two groups was statistically significant.

As pointed out above the Group IV. steers weighed on the average 1,050 lbs. on the 7th March, 1934, and the Group I. steers only 847 lbs. At this stage the Group IV. steers were of excellent and much better beef conformation and quality and in much better condition than those in the control group. They were so well developed and in such good condition that they were brought to the pens and finished off on a grain ration during a fifty-five day feeding period and exported as first grade chilled beef.

As these steers, like the others, were approximately 17 months of age at the commencement of the experiment on May 18th, 1932, they were only three years and three months when ready for finishing off (7.3.34) and three years and five months old when exported.

FIGURE 2.
Photographs of typical animals in Groups I., II., III. and IV.
14.12.1932.



Group I.—Control.
Group III.—Sodium and Chlorine Supplement (1 oz. Salt per day).

Group II.—Phosphorus Supplement (2/3 oz. D.-Ca-Ph.)
Group IV.—Protein Supplement (1lb. Peanut Cake).

This should be considered very satisfactory in view of the fact that most cattle in Southern Rhodesia on grazing only do not reach marketing weights until they are five or six years of age.

As the Group I. steers were by far not yet ready for finishing off they were continued in the experiment with Groups II. and III.

As pointed out previously these steers reached the average weight of 1,003 lbs. only 13½ months later, on April 23rd, 1935, when they were four years and four months old. Even at this time when they were put in the pens for finishing off, they by far did not have the quality, good beef conformation and finish that the Group IV. ones had before they were finished off thirteen and a half months previously. This is clearly shown by the fact that it took 122 days to finish off these steers as against 55 days for Group IV. When exported they were, therefore, 4 years and 8 months old.

From this discussion the following important facts emerge:—

1. On the poor sandveld pastures at this Institution growing cattle put on weight for three to four months of the year only. They then maintain themselves for a month or two and for the remaining six to seven months lose weight and condition very considerably—from 100 to 200 lbs. each.

2. For the first few weeks after the commencement of the rains the animals scour very severely, resulting in considerable loss in weight, and even death in some cases.

Investigations with a view to eliminating this loss in weight after the commencement of the rains on the young green grass are at present in progress

3. The animals making the largest gains or smallest losses during the winter months also make the largest total gains for the year.

4. The daily feeding of 1 to 1½ lbs. of ground nut cake during the dry winter months:—

(*a*) Prevents young growing cattle from losing condition during that time of the year.

(b) Improves their beef conformation, quality and finish and so considerably reduces the time and feed required to finish them off.

(c) Eliminates losses due to poverty and weakness just after the commencement of the rains.

(d) Reduces the age at which the animals are ready for marketing by 15 to 18 months and so lessens their cost of production and improves the quality of the meat.

The practical application of these results will to some farmers present certain difficulties.

There is first the cost of the ground nut cake. Let is be said immediately that the matter is being carried further and extensive investigations are in progress, some of which have just been completed, with a view to finding an economical farm-grown or easily obtainable supplement to take the place of the cake.

It should be pointed out here that the animals were grazed on extremely poor quality winter pastures. There are many farms, however, in the Colony where young growing cattle maintain their summer condition up to June, August and September, or where early summer grazing is available in September, October or November. In such cases the amount of supplement required will be considerably less, and hence the cost of supplementary feeding correspondingly cheaper.

The more technically minded will naturally ask whether it was the protein or energy in the cake that maintained the condition of the animals during the dry winter months.

From Table I. it would be seen that the winter grazing in this area contains on an average approximately 3% crude protein, which is the equivalent of about 1.5% digestible crude protein. Assuming, therefore, an average daily intake of 10-15 lbs. of dry veld grazing, an animal would ingest .15 to .23 lbs. of digestible crude protein. According to generally accepted standards(2) this intake would have been insufficient to supply the maintenance requirements of these animals.

From figure 1 it will be noticed that during the first winter (18.5.32—14.12.32) the animals not only maintained but slightly increased their weights up to September 21st. During the next four weeks they lost in weight. Their daily allowance of cake was then (20.10.32) increased from 1 to $1\frac{1}{4}$ lbs. (see Table IV.) and from then on until the rains came they again showed a slight increase in weight.

During the second winter (19.4.33—12.12.33) the animals maintained themselves to May 31st. During the next eight weeks (31.5—26.7.33) they decreased in weight very rapidly, but as soon as the daily allowance of cake was increased from 1 to $1\frac{1}{2}$ lbs. on the 31.7.33 (see Table IV.) there was an immediate increase in weight until the rains came and the animals suffered from scouring.

From this it appears that during the early winter months the animals suffered from a protein deficiency and that the feeding of 1 lb. of ground nut cake (45% crude protein) in addition to the veld grazing, met their requirements for protein, and that their requirements for energy (on the plane at which these animals were growing) were met by the grazing plus the surplus energy in the cake.

During the later months of the dry season, however, the animals no longer maintained their weights on the grazing and 1 lb. of cake, and it appears that they then also suffered from a deficiency of energy which was met by the small increased allowance of $\frac{1}{4}$ to $\frac{1}{2}$ lb. of cake per day.

Work is at present in progress to throw more light on this problem, but it seems probable that the main deficiency in the earlier part of the winter is protein, but later in the winter there is a deficiency of energy as well as protein.

These conclusions are very much in line with the results obtained on the wintering of yearlings by Potter[12] at the Eastern Oregon Branch Experiment Station. He states:— "We have not attempted to determine an absolute minimum of protein, but we have run enough tests with cotton seed meal and barley straw to show that 1 lb. of cotton seed cake was meeting the needs of the animal in a reasonably satisfactory manner, and that the use of additional amounts of cotton

seed meal produced results which were no more than would be expected from carbonaceous feed of the same energy content."

Conclusion.—It is concluded that the beneficial effects of the cake feeding was probably due during the earlier part of the winter to the protein supplied, and that later in the winter the effect was due both to the protein and energy in the cake.

The feeding of a supplement in the form of ground nut cake eliminated these deficiencies and prevented the animals from losing condition.

SUMMARY.

1. An experiment was conducted at this Institution to determine whether the feeding of phosphorus, sodium, chlorine and protein supplements would increase the rate of growth and improve the condition of growing cattle grazing on the sandveld pastures at this Institution.

2. Four similar groups of well bred Lincoln Red Shorthorn yearling steers were used in the experiment. Group I. (control) received veld grazing only, Group II. veld grazing plus 2/3 ozs. dicalcium phosphate daily, Group III. veld grazing plus 1 oz. sodium chloride (salt) daily, and Group IV. veld grazing plus 1 to 1½ lbs. of ground nut cake daily during the winter months only.

3. Daily, except Sundays, all the animals were fed *individually* and *individual* weights were taken at monthly intervals. Samples of blood were drawn from the animals in Groups I. and II. and analysed for inorganic phosphorus.

4. The feeding of the dicalcium phosphate and salt produced no visible effect on the weight or condition of the animals, and it is concluded, therefore, that the grazing supplied a sufficiency of these minerals for growth and maintenance. The intake of these minerals may, however, have been affected by the ingestion of an unknown quantity of browse.

5. The feeding of the ground nut cake during the winter months had a very favourable effect on the growth and condition of the animals. It decreased the mortality and increased

the rate of maturity, and it is concluded that these effects were probably due in the earlier winter months to the protein supplied and later to the energy as well.

6. Work is at present in progress to confirm the above conclusions and to investigate other aspects of the problem of deficiencies in our pastures during the winter months.

REFERENCES.

(1) Anderson, A. W. (1933). Problems of Animal Nutrition and Animal Husbandry in Northern Nigeria. *Tech. Communication No. 4, Imp. Bur. Am. Butr. Rowett Inst., Scotland.*

(2) Christensen, F. W. (1931). The Protein Requirements of Beef Cattle. *Proceedings Am. Soc. An. Prod.* 1931, 26-33.

(3) du Toit, P. J.; Malan, A. I.; Louw, J. G.; Halzapfel, C. R.; and Raets, G. C. S. (1932). A Study of the Mineral Content and Feeding Value of Natural Pastures in the Union of South Africa. *18th Rept. Direct. Vet. Services and Animal Ind., Union of South Africa*, 525-577.

(4) du Toit, P. J.; and Green, H. H. (1930). Dicalcium Phosphate as a Source of Phosphorus in Nutrition. *16th Rept. Direct. Vet. Services and Animal Ind., Union of South Africa*, 267-285.

(5) du Toit, P. J.; Malan, A. I.; and Groenewald, J. W. (1934). Minimum Mineral Requirements of Cattle ((2nd report). *Onderstepoort Jnl. Vet. Sci. An. Ind.* Vol. 2, No. 2, 565-606.

(6) Green, H. H. (1928). Determination of Phosphorus Compounds in Blood by Dry Combustion. *J. Agric. Sci.*, Vol. 18, 372-375.

(7) Malan, A. I. (1930). Mineral Metabolism and Blood Analyses. *16th Rept. Direct. Vet. Services and Animal Ind., Union of South Africa*, 307-311.

(8) Malan, A. I.; Green, H. H.; and du Toit, P. J. (1928). Composition of Bovine Blood on Phosphorus Deficient Pasture. *J. Agric. Sci.* Vol. 8, 376-383.

(9) Malan, A. I., and v. d. Lingen, G. W. B. (1931). Tht Micro-determination of Some Inorganic Elements in Blood and Vegetation. *17th Rept. Direct. Vet. Services and Animal Ind., Union of South Africa*, 443-452.

(10) Orr, J. B., and Holm, A. (1931). The Mineral Deficiencies in the Pastures of Kenya Colony and their Effects on Grazing Animals. *6th Rept. Econ. Advisory Council, Committee on Mineral Content of Natural Pastures, H.M.S.O., London.*

(11) Theiler, A., and Green H. H. (1932). Aphosphorus in Ruminants. *Nutrition Abstracts and Reviews*, Vol. I., No. 3, 359-385.

(12) Potter, E. L. (1927). Maintenance Requirements of Beef Steers. *Proceedings Am. Soc. An. Prod.*, 1927, 131.134.

Silage and Silos.

A number of enquiries have been received lately concerning the weight of silage contained in different types of silos. To enable the farmers to make an approximate estimate the following particulars are reprinted from Mr. W. J. Spafford's excellent bulletin No. 274 of the South Australia Department of Agriculture.

CAPACITY OF THE SILO.

In calculating the capacity of a silo it is usual to allow 50 cubic feet to the ton of silage, and although this is somewhere nearly correct on the average, the variations due to height of silo, type of fodder, succulence of fodder, whether it be chaffed or whole, and the weight added, are really considerable. It is easy enough to make a fairly close estimate of the tons of silage in a silo, by multiplying the surface area in feet by the depth of material in feet, and dividing the result by a figure between 45 and 55. This latter figure represents the space occupied by a ton of silage, the lower figure being used if there is a mass of silage 35 feet deep, and the greater figure for about 15 feet of silage. It is more difficult to give a general figure for estimating the amount of silage that can be put in a silo, because some receptacles can be heaped so far above the top that they are quite full of fodder after the mass has finished contracting, whereas others must be weighted down as soon as filled, and then the silage shrinks a long way below the top. For silos with fixed roofs it can be taken that on the average one ton of silage will be stored for every 70 cubic feet of air space in the silo, and for those with movable roofs or without roofs the figure will be somewhere between 45 and 60 cubic feet per ton of silage stored, according as the silo is filled or not.

In trench silos, which are always relatively shallow, and generally somewhere between 6 feet and 10 feet in depth, an allowance of about 60 to 65 cubic feet per ton is necessary. For instance, in a trench silo averaging 12 feet in width and 8 feet deep, every foot of length will hold about $1\frac{1}{2}$ tons of silage.

TABLE IV.—*Approximate Capacity of Various Cylindrical Silos.*

Inside diameter Silo.	Depth. of Silo.	Capacity of Silo.	Quantity when full of compressed Silage.	Usual quantity when Silo has has fixed roof.
Feet.	Feet.	Cubic ft.	Tons.	Tons.
10	15	1,178	21	15
10	20	1,571	30	21
10	25	1,963	39	27
12	15	1,696	31	22
12	20	2,262	43	30
12	25	2,827	57	40
14	15	2,309	42	29
14	20	3,079	59	41
14	25	3,848	77	54
14	30	4,618	97	68
16	20	4,021	77	54
16	25	5,027	101	71
16	30	6,032	127	89
18	25	6,362	127	89
18	30	7,634	161	113
18	35	8,906	198	139

TABLE V.—*Approximate Capacity of Various Square Silos.*

Length of Sides.	Depth.	Capacity.	Quantity when full of compressed Silage.	Usual quantity when Silo has fixed roof
Feet.	Feet.	Cubic ft.	Tons.	Tons.
8	10	640	11	8
8	15	960	17	12
8	20	1,280	24	17
10	15	1,500	27	19
10	20	2,000	38	27
10	25	2,500	50	35
12	15	2,160	39	27
12	20	2,880	55	38
12	25	3,600	72	50
14	15	2,940	53	37
14	20	3,920	75	52
14	25	4,900	98	69

TABLE VI.—*Approximate Capacity of Various Trench Silos.*

Width.		*Length.				
Top.	Bottom.	Top.	Bottom.	Depth.	Quantity when full of compressed Silage.	Weight per foot of length (excluding ends).
Feet.	Feet.	Feet.	Feet.	Feet.	Tons.	Lbs.
10	8	40	10	6	21	1,861
10	8	50	20	6	30	1,861
0	8	60	30	6	38	1,861
10	8	40	10	8	29	2,580
10	8	50	20	8	41	2,580
10	8	60	30	8	52	2,580
10	7	50	10	10	44	3,173
10	7	60	20	10	58	3,173
10	7	70	30	10	72	3,173
12	10	40	10	6	26	2,274
12	10	50	20	6	36	2,274
12	10	60	30	6	46	2,274
12	10	40	10	8	36	3,154
12	10	50	20	8	50	3,154
12	10	60	30	8	64	3,154
12	9	50	10	10	54	3,920
12	9	60	20	10	72	3,920
12	9	70	30	10	89	3,920
14	12	40	10	6	30	2,688
14	12	50	20	6	42	2,688
14	12	60	30	6	54	2,688
14	12	40	10	8	42	3,727
14	12	50	20	8	59	3,727
14	12	60	30	8	75	3,727
14	11	50	10	10	64	4,667
14	11	60	20	10	85	4,667
14	11	70	30	10	106	4,667

*A long slope each end, so that conveyances can be driven into pit from either end.

CAPACITY OF SILOS FOR KNOWN REQUIREMENTS.

When a decision has been made to erect a silo, it becomes necessary to calculate the amount of silage required, and to construct a silo of sufficient capacity to enable this quantity to be manufactured. If the silage is to be used for milking

cows, the number of cows to be fed must be multiplied by the amount to be given each animal daily, and the result multiplied by the number of days during which the cows are to receive silage. If the tons of silage required be multiplied by 50 cubic feet per ton of silage, the approximate cubic capacity of the silo will be found, and by reference to Tables IV., V. and VI., dealing with *capacities of silos*, the measurements of a sufficiently large silo will be seen.

TABLE VII.—*Quantity of Silage and Capacity of Silo for known requirements.*

Cows to be fed.	Silage per head per day.	Feeding period.	Quantity of Silage.	Capacity of Silo.
No.	Lbs.	Days.	Tons.	Cubic ft.
15	30	100	20.1	1,005
15	40	100	26.8	1,340
15	50	100	33.5	1,675
15	30	125	25.1	1,255
15	40	125	33.5	1,675
15	50	125	41.9	2,095
15	30	150	30.1	1,505
15	40	150	40.2	2,010
15	50	150	50.2	2,510
20	30	100	26.8	1,340
20	40	100	35.7	1,785
20	50	100	44.6	2,230
20	30	125	33.5	1,675
20	40	125	44.6	2,230
20	50	125	55.8	2,740
20	30	150	40.2	2,010
20	40	150	53.6	2,680
20	50	150	67.0	3,350
30	30	100	40.2	2,010
30	40	100	53.6	2,680
30	50	100	67.0	3,350
30	30	125	50.2	2,510
30	40	125	67.0	3,350
30	50	125	83.7	4.185
30	30	150	60.3	3,015
30	40	150	80.4	4,020
30	50	150	100.4	5,020

Southern Rhodesia Weather Bureau.

APRIL, 1936.

Pressure.—Barometric pressure was generally rather high over the whole country.

Temperatures.—Mean monthly temperatures were low, this was due to much cloud and low maximum temperatures, as the minimum temperatures were generally high.

Rainfall.— The rainfall for the month was patchy and the total about normal, leaving the total slightly below normal for the season.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Normal.	Temperature in Stevenson Screen °F. Absolute. Max.	Min.	Mean. Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation. Ins.	Normal	No. of Days	Altitude (Feet)
Angus Ranch... ...	...	...	84	56	78.4	60.9	69.6	70.4	67.6	64.1	83	62	...	0 87	1.24	7	..
Beitbridge...	968.8	...	94	54	82.8	62 2	72.5	...	70.4	64.7	74	62	4.9	0.27	0 54	1	1,500
Bindura...	890.7	...	83	58	78.9	53.7	71.6	...	69.5	65.5	81	64	6.4	1 09	1 75	3	3,700
Bulawayo	872.0	870.6	81	49	73.8	53.7	63.8	65.9	63.1	58.2	76	55	5.9	1 03	0.77	5	4,426
Chipinga	896.0	...	78	53	71.7	56.4	64.0	...	63.8	60.5	84	58	6.0	4.53	2.30	9	3,685
Enkeldoorn...	860.5	...	80	50	72.7	54.4	63.5	64.6	62 8	58.1	77	55	4.5	1.08	0.68	5	4,788
Fort Victoria	899.1	897.9	82	49	74.7	55.8	65.3	65.0	63.5	60.1	83	58	4.5	0 26	0 68	6	3,571
Gwaai Siding	907.4	...	89	50	82.6	56.2	69.4	...	66.8	60.9	72	58	2 7	1.71	1.42	3	3,278
Gwanda...	910.2	...	87	50	76.6	57.3	67.0	...	65.1	60.8	79	58	4 7	0.56	0.51	2	3,233
Gwelo	865.6	...	83	48	74.7	54.3	64.5	65.5	62 8	57.8	75	54	4.9	0.65	0 71	7	4,629
Hartley...	888.6	...	82	48	77.6	55.2	66.4	68.0	65.0	60.6	78	58	2.9	1.42	0.72	5	3,879
Inyanga...	839.3	...	77	40	71.4	50.5	60.9	...	62 6	55.6	65	51	2.8	2.08	1.03	9	5,503
Marandellas	840.4	...	76	47	71.0	52.9	61.9	...	60.3	55.8	76	53	4.4	2.53	1.28	6	5,453
Miami	881.5	...	81	52	76.8	56.9	66.9	...	64.8	61.2	82	59	4.8	1.87	1 29	5	4,090
Mount Darwin ...	910.2	...	82	49	78.2	57.8	68.0	..	66.6	62.9	82	61	5.1	0.86	0.55	3	3,179
Mount Nuza	804.3	...	65	43	57.2	47.3	52.3	...	52.6	51.2	91	50	7.9	8.51	...	15	6,668
Mtoko	880.2	...	82	52	76.6	57.1	66.8	...	67.1	60.6	69	57	3.5	0.13	0.55	2	4,141
New Year's Gift. .	...	...	87	53	78.0	57.8	67.9	...	65.0	61.2	81	59	...	1.95	0.72	6	2,690
Nuanetsi	966.5	...	90	52	81.7	59.7	70.7	...	69 3	65.6	82	64	3.4	0.62	0.68	8	1,581
Plumtree	867.9	...	83	51	74.7	56.7	65.7	...	64.7	58.0	69	54	2 4	2 43	1.15	5	4,549
Que Que	885.0	...	84	50	79.0	56.1	67.6	...	65.5	59.9	72	57	3.4	0.42	0 72	3	3,999
Rusape	865.3	...	78	46	72.2	53.3	62.8	..	60.5	57.5	83	55	4.5	1.79	1.17	6	4,648
Salisbury	857.5	856.3	81	47	75.9	52.8	64.4	65.5	64.4	58.3	70	54	4.1	1.03	1.05	8	4,885
Shabani...	914.0	...	86	52	76.6	58.4	67.5	...	67.1	62.4	77	60	5.2	0.35	0.67	3	3,131
Sinoia	891.2	...	86	49	80.7	55.6	68.1	...	66.6	61.2	74	58	2.8	0.10	0.98	3	3,795
Sipolilo	888.0	...	82	50	77.4	56.0	66.7	..	67.3	60.9	69	58	3.7	0.90	1.25	5	3,876
Stapleford	845.2	...	72	38	65.2	48.0	56.6	...	57.6	56.0	91	55	6.9	8.44	3.05	16	5,304
Umtali...	896.3	894.9	82	51	75.9	55.9	65.9	66.2	64.8	61.5	83	59	5.9	1.00	1.09	10	3,672
Victoria Falls... ...	...	...	...	...	...	...	...	...	...	...	...	...	..	0.33	0.64	4	3,009
Wankie	930.1	...	94	58	85.5	63.5	74.5	...	72.2	64.8	68	62	3.1	0.08	0.60	2	2,567

Southern Rhodesia Veterinary Report.

MARCH, 1936.

AFRICAN COAST FEVER.

Disease was diagnosed on the Salisbury Commonage, in the Salisbury Native District and on Maleme farm in the Matopo Native District.

FOOT AND MOUTH DISEASE.

Disease was located in Ndanga Reserve in the Victoria Veterinary District, with extensions to the farm Oatlands, Fort Victoria district, and Gwengombe Quarantine area on the Lundi River, in the Belingwe Native district. Inoculation of infected and incontacts by the intra mucosal method was immediately instituted, and no further extensions have occurred.

TUBERCULIN TEST.

Eight bulls were tested upon importation with negative results.

MALLEIN TEST.

Four horses were tested upon entry. No reaction.

IMPORTATIONS.

From the Union of South Africa.—Bulls 9, pigs 2, sheep 1,716, horses 4.

From Bechuanaland Protectorate.—Sheep 614.

From United Kingdom.—Bulls 2.

EXPORTATIONS.

To the Union of South Africa.—Oxen 198.

EXPORTATIONS—MISCELLANEOUS.

To the United Kingdom in Cold Storage.—Chilled beef quarters 732, frozen beef quarters 1,843.

MEAT PRODUCTS.

From Liebig's Factory.—Corned beef 21,780 lbs., meat extract 4,881 lbs., beef powder 41,075 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-36.

Monthly Report No. 41. April, 1936.

During April no winged swarms have been reported in Colony.

Outbreaks of Red Locust hoppers have been dealt with in the following districts, namely:—Makoni, Hartley, Salisbury, Darwin, Selukwe, Mrewa, Charter, Chibi, Gwelo, Belingwe and Nyamandhlovu.

Hoppers in an advanced stage were reported up to the end of the month.

The outbreaks in general have been comparatively light and in all accessible places have been effectively suppressed.

No disease or parasite attack has been recorded during the month.

RUPERT W. JACK,
Chief Entomologist.

Farming Calendar.

JUNE.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perenials, shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding

ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire-guards to prevent grass fires should be looked to.

POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

STOCK.

Cattle.—Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Where winter calves are required, the bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground nut cake or bean meal. Young calves are better in the pen on very cold mornings until the sun has gained some power, when they may run on short, sweet veld for a few hours.

Sheep.—Continue to feed the ewes and lambs well. Older sheep should generally also be given some supplementary feed now. Sheep should not be allowed to get into low condition, especially in areas where parasite infection is to be feared.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

JULY.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry our repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay

and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering-can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

DECIDUOUS FRUITS.

Pruning must be continued, and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects; or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inches over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Cost of Contour Ridging.—The expenses likely to be incurred in construction of contour ridges is a matter of interest to many farmers at the present time. The following letter, which was addressed to the Irrigation Engineer recently by Mr. H. L. Taylor, of the farm Insingesi, Bindura district, will therefore be of interest.

"For your records I submit the following particulars of the contour ridges constructed during the months of September and October, 1935, on this farm, situated in the Bindura district.

Total length of ridges...	52,700 ft., say 10 miles
Total length discharge drains	7,100 ft.
Acres of land protected	450 acres approx.
Cost of work done, ditcher and plough	£6 6 4½
Cost of trimming banks, making outlets, connections and discharge drains...	22 7 4
Boss boy, 48 days, @ 1/4	3 4 0
Total...	£31 17 8½
Cost per mile ... ... say	£3 3 9
Cost per acre... ... ... say	0 1 5

The method of construction adopted was Martin ditcher with extension and Ransomes plough, both with ox draught.

The fall given was .11 per 100 feet at apex of ridge, increasing .01 for each 100 feet. The ridges are generally about 3,000 feet in length, the fall in which case would be approximately 1 in 909 at apex graded to 1 in 400 at point of discharge into drains.

Ridges have been located at five foot levels.

No exceptionally heavy precipitation of rainfall was experienced during the past season. On February 14th 2.52 inches was recorded followed by 1.72 inches on February 15th, this total of 4.26 inches fell during a period of 36 hours.

On March 8th 2.37 inches was registered, our total seasonal rainfall to end of April was 28.72.

No damage was done to ridges."

Grain Crops.—World Production and Trade.—A report on "Grain Crops," covering the period 1928 to 1935, which has just been published by the Imperial Economic Committee, shows the improvement which has recently taken place in the statistical position of the wheat trade. The encouragement

given to agriculture, especially to wheat growing, in various European countries, together with the increased restrictions on imports, greatly reduced the demand for overseas grain and led to the accumulation of large stocks; this situation has altered materially in the past year and now, thanks to reduced acreage and drought, it appears probable that the world carry-over on August 1st next will be less than 17 million tons. In 1934 the carry-over exceeded 31 million tons. Expectation of the gradual liquidation of these large supplies led, during 1935, to an advance in price to the highest level reached since 1930.

The report is mainly a statistical analysis of the world production of and trade in wheat, barley, oats, maize and rice during the past eight years. It shows that the 1934 area and production of each of these five crops was lower than the average for 1928-1933 and that the Empire's share of the total stands at about 23%, though for rice alone 56% of the world production is grown within the Empire. The most notable change during this period is the increased production of wheat, barley and oats in the U.S.S.R., which has recently replaced the United States as the world's largest producer of these three commodities. Within the Empire Canada was formerly the largest producer of wheat and barley, but India now leads in these crops, as well as in maize and rice.

A feature of the report is the calculation of the Empire's net position with regard to the trade in each of these products. The Empire has for sale to foreign countries a considerable surplus of wheat and flour which frequently amounts, in the case of wheat alone, to more than two million tons. India normally has a surplus of rice sufficient to meet the import requirements of the other parts of the British Commonwealth, but for the secondary cereals it is necessary for the Empire to have recourse to foreign sources of supply.

Demonstration of Contour Ridging.—A most successful demonstration of soil and water conservation was given at Devondale farm, Concession, occupied by Mr. C. C. Tapson.

A general invitation had been extended, and some 150 persons attended, many of them travelling considerable distances. Among those present were the Minister of Agriculture (Capt. the Hon. F. E. Harris), Messrs. H. G. Mundy (Secretary for Agriculture), C. L. Robertson (Chief Irrigation Engineer), A. C. Jennings (Irrigation Engineer), R. H. Roberts, and P. H. Haviland (Assistant Irrigation Engineers), with several Members of Parliament.

There were also present delegates from various parts of the Colony who, at the invitation of the Government, were visiting various farms where soil conservation work is being carried out. The delegates were Messrs. A. B. Wilson (Bulawayo), A. E. Swan (Gwelo), D. Spencer (Hartley), L. Collett (Rusape), J. Rademeyer (Fort Victoria), and J. L. Martin, M.P. (Melsetter).

The demonstration began at 9 a.m. Contour ridges had been constructed beforehand on a badly eroded area of land, and the visitors first of all inspected these works. The ridges had been constructed by various methods; one ridge was made by means of a ditcher and plough, throwing up the earth on both sides of the ridge. Another ridge was constructed with ditcher and plough and the soil taken only from the upstream side of the ridge, while a third was built by hand labour and a fourth by dam scrapers.

On the day of the demonstration natives were employed extending the ridge made by hand labour under the supervision of Mr. Fussell. The ridge made with dam scrapers was also extended.

The various methods of operation were explained by members of the Concession sub-committee and signposts were erected explaining the methods employed. The height of the ridges was indicated by means of tapes stretched from the top of the ridges to the natural ground level. At each ridge there were also members who answered questions.

The photographs and the following description were kindly supplied by Mr. D. Aylen.

Fig 1.

Fig 2.

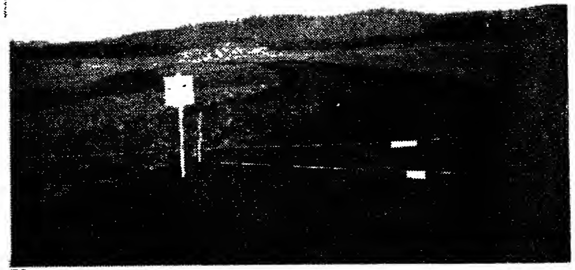


Fig 3.

Fig 4.

Soil Conservation Demonstration. For description see text.

Fig. 1. The locally manufactured ditcher making the first cut under the superintendence of a volunteer crew. The ditcher was capable of pushing up twice the amount of soil, but a photo under these conditions would only show a mound of earth.

Fig. 2. The upper side of a ridge made working on the upper side and throwing downwards only. The ploughing below was done on the return trips of the plough. The further tape shows the height (18 inches) of the ridge above original ground level whilst the nearer tape shows true level and to which water would back up. Note the "V" trench which is nearly 18 inches deep. This will be filled and widened by ploughing in to form a wide shallow trough.

Fig. 3. A ridge untouched by hand, made by plough and ditcher from both sides (18 inches high). Note the commencement of the flattening out of the "V" trench.

Fig. 4. A ridge almost completed at the demonstration. The donga has been smoothed out by throwing in soil with a plough and in bad places soil has been brought from the sides by an "Evans" type land leveller so that implements can cross.

The bank will be made up at the donga with a dam scoop working diagonally between the ridge and donga. A perfect finish of the "dam" can be obtained with a land leveller. Shovel work is only necessary when the erosion is so severe that pits have to be dug in order to obtain sufficient soil.

Essays on Soil Conservation.—Mr. C. L. Robertson, Chief Engineer, Irrigation Division, has kindly supplied the following information.

At the request of the Soil Conservation Council the Education Department last term arranged a competition for all schools and prizes were offered for the best essays submitted on "The Dangers of Soil Erosion and Methods of Prevention." The competition was very successful and in all over 240 essays were submitted from some 50 schools. Prizes were awarded for the best of these essays in each of the four sections as follows:—

Section I. Boys sixteen and over.

		Prize.
1.	H. M. Jansen, Umtali High School	£1 0 0
2.	L. G. Finch, Prince Edward School	0 12 6
3.	A. Parker, Umtali High School	0 7 6

Section II. Girls sixteen and over.

1.	D. Richards, Girls' High School	£1 0 0
2.	I. M. Booth, Girls' High School	0 10 0
	B. Donaldson, Convent, Bulawayo	0 10 0

Section III. Boys under sixteen.

1.	D. H. Saunder, Prince Edward School	£1 0 0
2.	A. Leo, Gwelo Coloured School	0 12 6
3.	E. Whitaker, Marandellas Public School	0 7 6

Section IV. Girls under sixteen.

1.	J. Findlay, Girls' High School	£1 0 0
2.	R. J. Carrol, Girls' High School	0 10 0
	K. Mulling, Convent, Salisbury	0 10 0

A special prize of 10/-, for the best essay, was awarded to Jean Findlay.

The standard of the essays generally was remarkably high as is shown by the following one, which received the highest marks in the competition. It is hoped to arrange to hold similar competitions in the schools each year, as it is felt that they are valuable.

Soil Erosion—Its Dangers and Methods of Prevention.

By Jean Findlay, Girls' High School, Salisbury.

(Age 15 years 1 month).

(Awarded 1st Prize in Section and Special Prize).

We all welcome the sight of the first black clouds which herald the entrance of the rainy season each year. For this is the time when all the trees and flowers and grasses bud out into fresh greenness, and the rivers which had flowed so languidly all winter suddenly awaken and surge up, overbrimming their banks with brown flood water.

But I wonder if we would feel so amicable towards the rivers if we all knew exactly what dyed the storm waters their lovely chocolate hue? This waste water, rushing madly down to the sea, is stained with the lifeblood of our land;

for it carries away, dissolved in it, soil which has been washed from the hills and plains of our country. "Water under control is the farmers' best friend, but uncontrolled it is his worst enemy, as it will eventually deprive him of his farm and deposit it in the sea."

This is what soil erosion means, and this constitutes the great problem which has now to be faced all over the world.

Before the white man came to South Africa, and ultimately to Rhodesia, nature provided her own means of fighting soil erosion, and prevented that part of the earth's crust which is South Africa, from being worn away by wind and water. The advent of the white man, however, has spoilt all Nature's plans, for he has cleared large stretches on which to grow his crops, build his towns, railways and roads, and is to-day faced with the serious task of preventing soil erosion.

The problem is none the less serious in Rhodesia, although we are a younger established country than, for instance, our neighbours, the Union. The land suitable for farming purposes in Rhodesia is limited in extent and is cut up by hills and rivers, therefore it is up to us, the inhabitants of this Colony, to realise our danger before it is too late, and prevent "South Africa (that is including Rhodesia) becoming a great desert uninhabited by man."

It seems strange to think that it is only of recent years that most countries have become alive to the menace, and have employed Commissions to investigate and report upon the matter. These reports make interesting reading and help to make us realise what we must not do if we are to preserve our soil.

As anyone of intelligence will tell us, the top seven inches of soil are the best, as they contain the vegetable matter and minerals necessary for the proper development of the plant. When this soil is removed, by water or any other means, the sub-soils are exposed, and as they have less nutritive quality the crops growing in them become poorer and poorer each year.

Grass is one of Nature's chief weapons with which she fights soil erosion. Consequently when the land is cleared of grass this armour is removed and the earth left bare and exposed to the ravages of erodents.

The farmer who burns this grass covering in order to clear his land is doing, perhaps unwittingly, several unforeseen things. He burns the top layer of humus—that decayed vegetable matter which is so valuable to the plant—as well as the fine grasses which the cattle find such palatable food. He mows the grass of his front lawn and yet burns the grass on the veld. He can see no relative connection between the two, does not realise how much thicker and more luscious is the lawn grass than that of the veld; and does not think, perhaps, how he is exposing the surface of the earth to the rays of the sun when he burns, so that the rain cannot soak into it, but just lies about in the pool which it scours out.

It has been said that the rainfall has less commercial value to-day than it had twenty odd years ago, and that the amount of rain which falls has been decreasing. Statistics prove that there is no appreciable decrease, but that it is because the results are less apparent that this assertion is made. We must prevent any further deterioration of the benefits of the rainfall, and to do this we must prevent soil erosion.

The next question to consider is in what ways may we prevent soil erosion continuing on the large scale that it is to-day, for it has been estimated that one quarter of an inch of soil is lost per year in the Mazoe Valley alone.

Soil erosion occurs in two main forms, with one of which I am sure we all all familiar, and that is donga or sluit formation. The other, while not perhaps so obvious to the less experienced is none the less dangerous, is sheet erosion, or sheet washing.

There is spread over the whole of Rhodesia a large network of old, abandoned roads, cattle tracks and native footpaths, and it would be interesting to see how many seasons' rain it took to convert these paths into dongas.

You may tell a farmer that by continually driving his cattle along the same paths to graze, water and kraal he will eventually be the cause of some of these long, ugly gashes in the earth which become raging torrents in the rains and enlarge each season. If he is a polite man he will profess incredulity, if he is otherwise he will flatly refuse to believe you. Yet it is the truth.

I wonder how many a stock-farmer who overcrowds his farm with animals, which trample down the vegetation and make tracks over the whole veld, realises just what he is doing? It is a well known fact that water follows the path of least resistance, and therefore is it not natural that if there are a large number of ready-made channels such as cattle tracks, that the water should flow along them, season after season, scouring out the earth as it flows and eventually forming dongas?

With an initial outlay of several pounds in fencing materials the farmer is able to construct several paddocks with a water supply in each, and can easily and safely enclose his beasts without fear of them excessively trampling down the vegetation all over his farm. There is also another advantage in the paddock system. By having several of these paddocks and by transferring his animals from one paddock to another the farmer is able to graze down his grass and so avoid the necessity of burning it out.

There is many a farmer to-day who finds it necessary to make use of the vlei land on his farm in order to increase the acreage under cultivation; and so in a very well-meaning but ignorant way, he proceeds to drain the vleis. He cuts a channel downhill so that the vlei may empty itself more quickly, and after a time it is ready for the plough. There is an old trite saying that we must "look before we leap," and it is certainly applicable in this case.

Never cut a channel through a vlei to drain it, unless it is on flat land, so that the runaway may be easily blocked and the vlei reformed if necessary; and never plough a vlei land unless there is a strip of virgin veld left at the bottom to check the flow of water off the land when it becomes flooded. Vleis were always tricky things to handle, but treat a vlei sensibly and you need never fear for the results.

There remains the care of that part of the farm which is not used for grazing or planting, and it is none the less important to prevent soil erosion in the less frequented parts than in any other. Fire guards must be cleared round the farm to prevent the vegetation from being destroyed. River banks and hill slopes must preserve, as nearly as possible, their natural vegetation as the roots of trees and grasses mat the soil and also prevent it from becoming baked by the heat of the sun. If the areas that have been cleared of timber are replanted, a double reward will be obtained, for besides reducing the risk of erosion, the timber can always be sold and thus repay expenses.

The care of farm roads is essential. If a road is once made with sufficient camber and suitable storm drains on either side, and is kept in good condition, there will be no risk of erosion, and would-be-users will pass no cutting remarks about the condition of farm roads.

Perhaps one of the most serious aspects of a donga is the one least obvious to the uninitiated. Underground water cannot rise above the bottom of the deepest rut, therefore if there are a large number of dongas in one vicinity, the water level of the whole region is lowered. If this occurs on an extensive scale the water supply may be seriously impaired, springs and wells will dry up and the condition of life will be made extremely difficult.

As all this is due to the advent of the white man, let us try to make reparation for what we have done and endeavour to check the spread of soil erosion. In this case, as in every other, prevention is better, and cheaper, than cure.

The golden rule in the code of preventing dongas, is to catch them as young as possible, for the older they grow the larger and more menacing they become.

The chief method used in preventing dongas from enlarging is to build barriers across their course which check the flow of the water and force it to drop its silt. Naturally the larger the donga the more substantial barrier is needed; with small sluits a fence of stakes and brushwood firmly inter-

laced usually suffices. With the larger type, however, boulders are necessary and the banks have to be sloped back and planted with vegetation, while the ends of the barrier need to be suitably protected against undercutting which is liable to occur.

If the slope is very steep a greater number of barriers have to be constructed in order to bank the water up so that the water level of the lower barrier comes to the foot of the one above. As one would expect, expense increases with size, so that if we are to save our pockets as well as our soil we must prevent dongas forming at all.

Sheet washing is a different form of erosion from the donga, because it is a stealthy and more gradual process and the development is less noticeable than in the sluit formation.

Cultivated and cleared lands are the ones which are effected most, and the usual signs of sheet erosion are little ruts which begin to appear in the lands, the turning up of sub-soils when ploughing and the subsequent decrease in the quality and quantity of crops.

Therefore we must protect our lands as soon as they are cleared, and the best methods are practicable. The expense entailed in such protective works is nothing compared with the benefits received.

Storm drains are constructed above the lands, of sufficient depth to carry a large volume of flood water without the risk of an overflow on to the lands. The lands themselves, if sloping, are protected by a number of earthen ridges, called contour ridges. These run in parallel lines at right angles to the slope of the land and vary in height, as the drains do in depth, according to the amount of rain water which generally falls in that part. The water is dammed up behind the ridges and is then conducted into the side storm drains. The soil collects behind each ridge and often converts sloping lands into a number of flat terraces built up with the rich top soil washed from the slope above.

Flatter lands are not so subject to the ravages of soil erosion, although the run-off of water which actually falls on cultivated lands, no matter their gradient, should be checked;

and ploughing should always be across the slope and never down it, in order to avoid the possibility of the formation of channels.

A word to the miner, too, might not be amiss, for if he always filled in his trenches behind him or suitably protected them against the possibility of their becoming dongas, he would have no cause to alienate the goodwill of the farmer on whose land his mine is situated.

With all this information before us—how to prevent and, to a certain extent, cure soil erosion—can we not do something about the matter? Only ten per cent. of the lands of Rhodesia are suitably protected against soil erosion, and this number is only added to by a two per cent. increase per annum. It seems startling and rather amazing to think that so few landowners take advantage of the expert advice available in the construction of protection works, and that there are not more people ready to help themselves, their neighbours and the Government fight the menace that threatens to overwhelm us all. The Government is prepared to undertake the care of the land in native reserves, and cannot we all do our bit to help them save our country for us? It rests with us, the people of Rhodesia, and let us not fail in what is, I am sure, our duty.

Some Notes on Cotton Growing.

By J. E. PEAT, Senior Plant Breeder, Cotton Station, Gatooma.

Soil.—For best results cotton, like most other crops, requires to be grown on land of fair depth and fertility. On good land it gets away earlier, sets a bigger frame, flowers and fruits more freely, and is better able to come through a drought period. It will grow and produce reasonable crops on a range of soils, but for optimum results it requires soil of fair depth and good drainage to allow of proper root development.

On very rich land there is a tendency for the plants to grow rank. On such land, earliness of planting is of the greatest importance, and a slightly wider spacing than is usual should be employed, 3 feet 6 inches to 4 feet between the rows and a spacing of, say, 18 inches in the row.

Seed.—It is important always to use only the best seed. At the Cotton Station, Gatooma, continuous breeding and selection work has been going on for some years improving the yielding and other qualities of the crop for Southern Rhodesian conditions. From the ginnery only the best seed available will be issued to growers.

Time of Planting.—Cotton should be planted as early as possible after the first planting rains. This is normally from about the middle to the end of November. It is not wise to plant until two to three inches of rain have fallen. If planted after a first fall of, say, an inch, the seed may germinate, but the plants die off before the rains start properly. This early planting is for two main reasons. Firstly, it allows the crop to develop as far as possible while temperatures are relatively high, and to ripen most of the crop before frost. Secondly, early planting allows a crop to set before the most serious insect pests become troublesome. In a year such as the last, good results have been obtained from cotton planted later

than is normal. But even in this past year, the best results have been obtained from crops planted as soon as possible after the rains started, even if these first rains did not come until well on in December. In most years, with moderately early planting rains, a crop planted towards the end of November stands very much more chance of being a success than crops planted after the middle of December.

Elevation and Temperatures. In the higher lying area of the country over, say, 4,500 feet, the normal season is on the short side for really successful cotton growing. Low temperatures slow down the development of the plant. Frost kills off the leaves and prevents all but the almost mature bolls from ripening and opening. In such areas, early planting of the crop is of even greater importance than for areas of lower altitude. In the higher areas, much depends on whether the crop is growing in a sheltered situation or not. And, of course, lands adjacent to streams or vleis are more liable to frost damage.

Seed Rate.—To ensure a good stand, with a machine planted crop, it is necessary to plant about 30 lbs. of seed to the acre. With hand planting a lower seed rate can be employed. With 3 feet 6 inches between the rows and 9 inches to 1 foot spacing in the row, six seeds to a hill, the planting rate would be about 15-20 lbs. an acre.

Depth of Planting.—It is very important not to plant cotton seed too deeply. Seed should just be covered by the soil. In machine planting "shoes" may be affixed to the runners of the planter to prevent the seed going too deep. If planted too deep a fair percentage of the plants may die off before reaching the surface.

Growth.—Everything should be done to assist the crop to get away early. Land should be thoroughly ploughed and harrowed, and it is of the greatest importance that the crop be kept clean in the early stages. A well grown crop should be about 2 feet 6 inches to 3 feet 6 inches high. With smaller grown plants quite good yields may be obtained, but there is less framework to carry a good crop, and less chance of recovery after drought or American Bollworm attack. Very rank grown cotton is more liable to bollworm and stainer.

Spacing and Time of Thinning.—Thinning should be done about a month to five weeks after planting, when plants are getting into their second and third leaf, and are about 4 inches high. If thinning is unduly delayed, the competition of the plants checks proper development. The rows are normally 3 feet to 3 feet 6 inches apart, and for most growers plants should be thinned out to one plant to a hill with 6 inches between, or two plants to a hill with 1 foot between. When gaps occur wider than 1 foot, three plants to a hill should be left. On rich land, however, as has already been mentioned, a wider spacing could be employed. It is probably unwise, generally, to leave bigger clumps than three plants to a hill.

Early Cultivations.—It is important that the crop should not be checked by weeds in the early stages. The early cultivations and hand hoeings are the important ones. If the land tends to be weedy, the crop should be cultivated before thinning, and hand hoed after thinning. Two more hand hoeings, and probably another three cultivations, would be about normal, where cultivators are used. But everything depends on how weedy or otherwise the land is. It is unwise to cultivate with cultivators after the crop has started flowering freely. The cultivation immediately before the flowers open should not be deep enough to destroy the lateral roots.

Picking.—Picking should commence when, for a good day's work, a picker can pick around 40-50 lbs. seed cotton per day. With a good opening crop, even more than this can be picked in a day. Care should be exercised to pick cleanly. Much broken leaf and trash mixed in with the seed cotton considerably lowers the value. Badly stained seed cotton, or seed cotton in badly opened bolls, should not be taken in a first picking, but left for a later clean-up. The ideal arrangement is probably two main pickings and a final clean-up. The longer seed cotton is left in the field the more trash and dirt is blown into it, and the more difficult it is to pick cleanly.

Yields and Values.—A good yield of cotton in this country is over 750 lbs. seed cotton to the acre. A fair to good yield would run from about 400 lbs. to 750 lbs. per acre. An average of 250-300 lbs. seed cotton per acre over a period of years should be about the low average mark. The price which can

be paid for seed cotton depends on the cleanliness of the seed cotton and on the world price for lint at the time, together with the cost of ginning, handling, and marketing the crop.

Packing and Sale.—Small quantities of cotton can be transported to the market in sacks; about 50 lbs. of seed cotton in a sack. Larger crops should be packed in woolpacks. Well trampled in, about 400 lbs. of seed cotton can be got into a woolpack. For native cotton, arrangements will always be made for the supply of woolpacks and sacks, and for the purchase of seed cotton at notified centres in each area.

Insect Pests.—There are four main pests of cotton in Southern Rhodesia—Jassid, American Bollworm, Sudan or Red Bollworm, and Stainer. Without these pests cotton growing would be relatively simple.

Jassid.—Jassid is a small plant sucking bug which, as far as is known, in feeding, injects a poison into the plant. This destroys the green colouring substance in the leaf and thus interferes with the growth of the plant. It has been found that plants with hairy leaves are unfavourable to jassid, and are thus resistant to attack. The seed stocks at present available have a fair degree of resistance, allied to other good qualities, such as earliness and free fruiting habit. It is only in exceptional years that the strains at present being grown will suffer much from jassid. Newer strains with greater jassid resistance are being bred up at Gatooma, and in a year or two will be available to all growers.

American Bollworm.—At the present time in this country American Bollworm is the most serious pest to cotton growing. The moths lay eggs on a wide range of plants while they are at the flowering stage: the caterpillars which hatch out from these eggs feed freely on the buds, flowers and fruits. Maize, beans, tobacco, kaffir corn, etc., are all freely attacked as well as cotton. In the main maize areas the serious damage to cotton tends to occur when the commercial maize has ceased tasselling. Any farming measure which helps towards having other crops flowering at the same time as the main cotton crop is in flower alleviates the American Bollworm position.

Sudan or Red Bollworm.—With this pest the caterpillars, naturally, feed only on wild cotton plants in the veld, or possibly on plants in the veld very closely related to cotton

(the moths hatch out after the first rains in October November-December), and it is probable that egg-laying moths travel considerable distances. If there is any stand-over or ratoon cotton being grown, the moths concentrate on such cotton and lay eggs freely, thus producing a large second generation of moths to attack the main cotton crop when it has reached the proper stage of growth. *It follows therefore that any leaving of cotton crops stand-over from one season to the next, or any system of ratoon crops, will be most harmful to the industry, and should be prohibited.*

Stainer.—Stainers are plant sucking bugs, reddish in colour, and about $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in size. They live naturally in the veld on plants related to cotton. Where they are a very serious pest there is little that can be done to ease the damage. In fact, in some areas in this country it is probable that the attack of stainers will be the limiting factor to native cotton growing. In some of these areas, where irrigation is available, it may be possible to dodge stainer attack by planting cotton out of season. In most areas, however, where stainers are not normally the limiting factor to cotton growing, crops which are planted early are less liable to attack. As with Sudan Bollworm, any system of stand-over or ratoon cropping encourages attack.

In native areas, with small gardens under cotton, it would probably be quite practicable to destroy the batches of very small young stainers which feed on the first open bolls. This helps to lessen the damage from the second generation.

Aphis.—The plant louse, or aphis, attacks cotton and many other crops, during the growing season. From the feeding aphids a sticky honey-dew is deposited on the plants. In a season with drought periods in February-March this is especially noticeable. This, however, is not serious, as it disappears as the season goes on.

In some quarters an idea has been gaining ground that it is necessary clear away bush from the edge of cotton fields or plots in order to protect the crops from insect attacks. Such a practice is not necessary, as the majority of pests which attack cotton in this country may travel from considerable distances.

Investigations into the Causes of a Number of Soft Pigs,

MARKETED AT NEILL'S BACON FACTORY, SALISBURY.

By A. E. Romyn, Chief Animal Husbandry Officer.

A number of soft pigs were marketed at Neill's Bacon Factory in March and April last. Five small consignments of pigs from different owners were examined at the Bacon Factory by the writer in co-operation with Mr. F. Neill. The pigs were light in weight and obviously soft and flabby after a chilling period of 24 hours. The iodine number of the backfat of these pigs was determined by the Division of Chemistry and varied from 66-76. An iodine number of above 60 is taken to represent an undesirable degree of softness in a bacon pig and these pigs, whatever the cause, were unquestionably soft.

The rations of these pigs had differed from the common ration of maize and separated milk in that they had contained varying quantities of such feeds as bloodmeal, meatmeal, munga and wheat by-products. In some quarters there was a tendency to attribute the softness of the pigs to the use of one or more of these feeds.

Wheat by-products were especially under suspicion though, on the face of it, it appeared unlikely that these feeds could have caused soft bacon. Samples were, however, obtained of the various feeds used, and the oil content of these determined. The results showed no significant difference from the accepted local composition of these feeds.

A list of a number of regular suppliers who had sent in soft and firm pigs recently was therefore obtained from Mr. Neill and a questionnaire was sent to each supplier in an attempt to determine which of the usual factors, if any, were likely to be responsible for the soft pigs which had been

marketed. The questionnaire circulated asked for particulars in regard to feed, breed, age, marketing weights and methods of management of the pigs killed.

A good response to the questionnaire was obtained and the deductions from the replies are summarised in this report for general information and guidance.

It must be emphasised that it has not been possible to check the information given, either as regards the softness of most of the pigs, which had already passed into the cure, or of the rations used. The grading for softness was taken from factory records, the account of the ration, weights, ages, etc., was supplied by the supplier concerned.

It would probably be as well to explain, in the first place, that soft fat is generally due to immaturity or to incorrect feeding.

To understand this statement it is necessary to know something about the way in which fat is formed in the body of the pig.

The pig synthesises fat from the fats, oils and carbohydrates in the diet and indirectly from the proteins. Generally speaking, the fat synthesised from the fat and oils is soft and that from the carbohydrates and protein is firm. Some fats and oils are much more softening than others. Thus the fat in meatmeal forms comparatively firm fat in the pig, whereas that from bran and maize meal forms comparatively soft fat. The supply of protein in the feed is nearly always too low to make it an important source of fat under ordinary conditions and it is therefore left out of consideration in this discussion.

The fat and oil is drawn on first for the formation of the body fat. When there is a large amount of fat or oil in the diet the fat laid down in the tissues will therefore come mostly from the ingested fat in the feed and will, as a result, be generally very soft. If there is only a small amount of fat in the diet, most of the fat formed will come from the carbohydrates, which form firm fat. The effect of the ingested fat will, in such a case, be small, and the tissue fat as a whole will be firm.

The effect of the ingested fat is greater in young pigs than in old pigs, because the young pigs do not naturally form much fat in their bodies and can therefore get most of the fat required for fat laid on from the fats in their rations, hence young pigs tend to be soft. As these pigs grow older, the rate of deposition of fat in the tissues becomes much greater. The pig is then forced to use more and more of the carbohydrates in the diet for fat formation and the fat in the tissues becomes firmer. Hence pigs tends to get firmer with age.

A pig which is brought on slowly, or is unthrifty, and is consequently not laying on much fat can, in a similar way, fill most of its fat requirements from the fat and oils in the feed. Hence the fat laid on by a pig which is fattened slowly is generally softer, other things being equal, than the fat of pigs which are fattening quickly and have to draw mostly on the carbohydrates of the feed for most of their fat tissue requirements.

In other words, young pigs, pigs fed diets high in fat and oil—such as ground nuts, sunflowers—pigs brought on slowly or marketed not properly finished, all tend, other things being equal, to be soft.

According to the statements made by suppliers it does not appear that the softness of the pigs on which these reports were made could be attributed directly to the rations as, meatmeal, bloodmeal, wheat by-products, munga had all been fed in considerable proportions to pigs which were graded firm by the factory. While the possibility of some misrepresentation cannot be ruled out in the case of producers supplying "soft pigs," no such temptation should exist in the case of suppliers of "firm pigs" who would have no cause to misreport the rations used.

Pigs in both groups, firm and soft, had been kept in sties throughout or run on pasture.

The composition of all the samples of feed tested was normal, and it seems, therefore, reasonable to conclude that the feed was not the direct cause of the trouble, especially as the feeds under suspicion have been commonly used elsewhere with satisfactory results.

According to the information supplied, however, the pigs marketed in the two groups differed in the following particulars:—

1. The pigs in the "soft group" were on an average marketed one to two months older than those in the firm group.
2. The pigs in the "soft group" were on an average 15-20 lbs. lighter in weight at the time of marketing.
3. There was a far greater proportion of Large Black blood in the "soft group."

There was, of course, some overlapping between the two groups, but on the whole the above picture holds true.

In other words, most of the pigs in the "soft group" were, on the face of it, probably not so thrifty, not so well finished and slower maturing than those in the "firm group."

The data therefore points to the conclusion that the rations of themselves were not the cause of the trouble, but that the soft pigs had not been properly finished.

General enquiries made in regard to the supplies of pigs to two factories in Bulawayo seem to lend further support to this view, as pigs which are known to have been fed considerable quantities of bloodmeal, meatmeal and munga were graded firm at the factory.

There does not appear therefore to be much reason to suspect that the explantion of soft pigs under local conditions is other than the one offered.

The assumption is, however, being checked at the Rhodes Matopo Estate, where different lots of pigs are being fed various rations containing meatmeal, pollard and palm kernel cake.

Several suppliers have raised the issue, however, that pigs on identical rations had never been graded soft on previous occasions. They implied a change in the grading standards. The detailed information is not available to check these statements and it is not attempted to pass any opinion on this

point. The general explanation given would, however, account for softness at any time and should be studied by each feeder to see in what degree they apply to his particular circumstances.

It is of interest to note that this outcrop of soft pigs has coincided with a shortage of maize for feeding in the case of several suppliers. The shortage of maize was made up in some instances by the purchase of wheat by-products, to which reference has been made. These bought feeds were then fed lightly to economise expenditure, the pigs were given a good deal of roughage and were marketed at light weights to save concentrate feed. Under such circumstances one would expect the pigs to kill out softer than usual.

To secure the maximum firmness possible oily feeds must be avoided and the pig must be fed properly and well finished.

Mycological Notes.

EPIDEMIC WILDFIRE AND ANGULAR SPOT IN TOBACCO.

Contributed by the Branch of Plant Pathology.

A paper of considerable interest to Rhodesian tobacco growers has appeared recently in the *Journal of Agricultural Research*(*). It deals with the conditions which cause wildfire in tobacco to become epidemic.

It has long been known in Rhodesia that wildfire more often than not fails to live up to its name and reputation, and as a consequence some growers have been lulled to a false sense of security only to be bitterly disillusioned later. It has also been known that heavy storms, cold misty spells and continuous rains, especially if accompanied by driving winds, may be the forerunners of a severe outbreak of wildfire, but that an epidemic need not necessarily follow a period of wet weather. The behaviour of the disease has, therefore, been something of a mystery.

The paper under consideration, which is well illustrated by exceptionally good photographs, throws considerable light upon the erratic behaviour of wildfire and shows that the development of the casual organism, *Bacterium tabacum*, is largely dependent on the water content of the tobacco leaves. Most of us have noticed how leaves show dark green, water-soaked patches of several square inches in area during and immediately after heavy rain, the condition being generally attributed to bruising. Whether this is so or not is not of great importance; the essential point being that the leaves are "flooded" with water which fills the spaces between the cells, usually occupied by air, and creates an uninterrupted channel along which bacteria can swim with relatively great rapidity. If these areas become infected before the excess of water evaporates, then the cells are killed by the bacteria and large brown blotches remain when the lesion dry out.

*Clayton, E. E.—Water-soaking of Leaves in Relation to Development of the Wildfire Disease of Tobacco. *Journ. Agric. Res.* 52, pp.239,269, 1936.

From experiments carried out by Dr. Clayton it appears that wildfire bacteria are incapable of penetrating the leaf tissues for any considerable distance when the water content of the plant is normal, so that infection is limited to a small area and the well known "halo" type of spot is formed in about a week. When, however, water-soaking was effected artificially, large lesions of the epidemic type were formed in 48 hours. It was also found that the water-soaking needed to persist for 24 hours for the epidemic phase of the disease to develop, and that if the leaf dried out rapidly, as after a short storm, then the "halo" spot alone appeared.

Water-soaking of the leaf was found to depend on many factors and was greatly facilitated by exposure of the lower surface of the leaf. It frequently happens in Rhodesia that leaves are turned over by high winds and it is common to see large water-soaked areas on the lower surfaces after a heavy thunderstorm. Excessively wide leaves are very easily blown over, and would therefore appear to be more susceptible to wildfire than those not so broad. Dr. Clayton also found that low-topping and high-nitrogen fertilisation facilitated water-soaking, and hence favoured development of the disease; conditions which are well known in Rhodesia. It should, however, be noted that *high-nitrogen* fertilisation and *low-topping* were the contributory factors, which does not necessarily mean that plants should receive *low* dressings of nitrogen and remain untopped. Faulty cultural practices may quite well do more damage to the crop than a mild epidemic of wildfire. Furthermore, it must not be thought that certain cultural practices are the cause of wildfire; the disease will not develop unless the specific organism is present.

This article serves to show why wildfire is regarded as an unimportant disease by some growers, who evidently have not experienced weather conditions on their farms favourable to the development of the epidemic phase. It can be seen, however, from the results of Dr. Clayton's work that it is potentially a serious menace and is only held in check by the relatively frequent spells of dry weather which are common to Rhodesia during the growing season and prevent prolonged water-soaking of the tobacco leaf.

It has been observed in a number of cases in the Colony that similar conditions pertain with angular spot, though the differences in symptoms between the epidemic and what may be termed static phases are not so pronounced as with wildfire.

A considerable number of specimens have from time to time been received in the Plant Pathology laboratory of heavy and "sappy" leaf possessing very large, somewhat rounded lesions due to *Bacterium angulatum*, the angular spot germ. Examination of leaves showed that water-soaking of the tissues had occurred and that the bacteria had progressed rapidly from the initial point of infection throughout an area as much as 2 inches in diameter. In many cases quite abnormal symptoms were produced, in the form of broken concentric rings of green or yellowish tinge alternating with brown dead tissue. It appeared that the bacteria had spread outwards so rapidly that certain cells were invaded and killed before infection of the intervening tissue was accomplished. This rapid diffusion of the germs in the leaf is in striking contrast to their usual behaviour where progress is slow and easily arrested by the small veins, which give the normal angular appearance to the spots.

Experiments with Clover and Winter Grasses at Rusape.

LIME THE FAIRY GODMOTHER OF VLEI SOILS.

By EVELYN TAPSON, Hon. Secretary, Rusape Farmers' Association.

Several farmers in the Rusape and Headlands area are co-operating with the Agricultural Department in testing out some of the most promising grasses under wet vlei land conditions. It is considered that some 30,000 to 50,000 acres of similar soil is available in these areas alone which is suitable for putting down to permanent pastures and which can be converted into valuable summer and winter pasture providing succulent green grass throughout the year.

The small beginning already made by a few farmers it is hoped will soon prove to others the value of our granite vlei lands which hitherto have been looked upon as being useful only for early grazing produced by winter burning.

Mr. D. E. McLoughlin, the Government Agriculturist, accompanied by Mr. W. E. Tapson, the Secretary of the Rusape Farmers' Association, visited several members to inspect and advise on the pasture grasses under trial on farms.

It cannot be denied that the results to date are definitely encouraging. By the end of this winter it is hoped that farmers in this area would have learned sufficient about their prospects to justify substantial acreages being prepared for next season's planting.

Treatment.—In nearly every case the same unhealthy condition of the grasses obtained where the preparation of virgin land did not include an application of lime.

The most outstanding success has been obtained in one case, by Lieut.-Col. Brighten, on Castle Base farm, where the land, a typical black acid vlei soil, received a dressing of

one ton of lime per acre plus a complete pasture fertiliser applied to the grasses and Kenya Governor wheat at the time of planting. The crops are growing without any irrigation.

The response of the grasses and wheat to the basic dressing of lime is most striking, indicating the ideal conditions required for the establishment of young seedlings.

The vlei land was prepared only one season in advance of planting, but the thorough cultivation it received, plus the lime, allowed it to sweeten up in a remarkably short time.

Other outstanding successes are to be seen on old vegetable garden beds where the vlei soils had been brought into the required condition by previous cultivation of vegetables.

On Mr. Harrington's farm, Harleigh, winter grasses and clover are growing luxuriantly, also without irrigation.

Thus far only a few of a very wide range of grasses and clover have been tried, including Perrenial Rye, Cocksfoot, Fescue, Yorkshire Fog, Paspalums Dilatatum, Virgatum and native paspalum (*Scrobiculatum*), Swamp Couch and Kikuyu. Of the many cloves White Dutch appears to be the only one tried.

Experimental work, including the testing of all promising winter pastures, is an expensive undertaking which no farmer can really afford; neither can he afford the failures associated with experiments of any nature. Further, the duplication of the process, if it has to be carried out by individual farmers, will of necessity amount to a considerable sum of money.

A Promise.—The promise of the Minister of Agriculture to favourably consider the establishment of a vlei land Demonstration Station on a piece of Government owned land at Rusape has considerably stimulated interest in the possibilities of vlei land pastures as opposed to wheat growing—an industry which it is feared will reach saturation point in the very near future and provide us with a surplus to be exported at a loss. With chilled beef as the ultimate alternative outlet for over-production in wheat and dairy produce.

The establishment of a suitable permanent pasture has much to commend it. Stock improvement in this Colony must be preceded by pasture improvement, more so if we have to compete with established countries, to quote only New Zealand as an instance, whose income is derived mainly through the cow.

A Start in Sight.—Several farmers in the Rusape area are already sweetening up land to prepare for those pastures which will show most promise, while a few are also considering the purchase of lime to render their vlei soils suitable in the shortest possible time. It is hoped that the Railways and the manufacturers of lime will consider the possible outlet for lime through its possible increased use, and place it at the disposal of grass farmers at a reasonable landed price. It is also the feeling that little is as yet known on the best methods of drawing of the surplus moisture from granite vlei soils without seriously affecting their subsequent moisture holding capacity, and the hazard of soil erosion through drains on these vleis. Full advantage could be taken of the demonstration plot to demonstrate methods of draining by the Irrigation Department.

The value of swamp couch grass as a ground cover for open drains has already been demonstrated on Mr. Harrington's farm, where this valuable grass appears quite at home growing in standing water, while two others also showing promise are Paspalum Dilatatum and wild rice grass.

A suitable acreage can also be placed under irrigation on the demonstration plot, which could be used to advantage on wheat work conducted for irrigation farmers.

The new Laboratories.

Annual Report of the Senior Plant Pathologist

FOR THE YEAR ENDING 31ST DECEMBER, 1935.

(Continued.)

PART II.—TOBACCO RESEARCH.

(Publication approved by the Tobacco Research Board.)

Staff.—Mr. T. K. Sansom, B.Sc., Plant Breeder, and Mr. H. F. Ellis, B.Sc. (Ag.), M.Sc. (Chem.), Tobacco Research Officer, were transferred to the Tobacco Research Station in January, having previously made visits to the Station from time to time to supervise seed-beds and planting.

On 19th March Mr. Sansom returned to the Hillside Experimental Station on transfer, and early in April Mr. J. F. O'Dea, Lay Assistant, was transferred to the Audit Department, Salisbury.

During the year the following additional officers were appointed to the resident staff:— Dr. A. A. Moffett, B.Sc., Ph.D., Tobacco Plant Breeder, on June 20th; Mr. H. C. Thorpe, B.Sc., A.I.C.T.A., A.R.C.S., Tobacco Plant Breeder, on September 26th, having previously taken a "refresher" course in plant physiology at the Rothamstead Experimental Station from April 1st; Mr. J. C. Collins, B.Sc., Lay Assistant, on August 13th; Mr. V. G. Smith, Lay Assistant, on October 16th; and Mr. R. R. Slocock, Clerk, on August 1st.

Mr. H. F. Ellis assisted in the carrying out of the duties of the Chief Tobacco Officer during the latter's absence on sick leave, for a period of two and a half months.

On December 20th, J. C. F. Hopkins, D.Sc., A.I.C.T.A., Senior Plant Pathologist in charge, took up residence on the station.

Movements.—The Senior Plant Pathologist paid eleven visits to the Tobacco Research Station, Trelawney, during the year.

The Tobacco Research Officer toured the Lomagundi district to report on the tobacco crop.

Dr. Moffett spent several weeks visiting various tobacco warehouses for the purpose of studying grading and also journeyed to Gatooma to discuss plant breeding with the staff of the Cotton Station.

General.—The 1934-35 season was one of many difficulties.

Owing to lack of housing accommodation it was not possible for the Plant Breeder and the Tobacco Research Officer to remain permanently on the Station, so that the seed-beds and the early crop were managed almost entirely by the Foreman, with occasional supervision by technical officers.

As a consequence of the absence of the technical staff early in the season, it was found necessary to fertilise some plots after planting, and the Tobacco Research Officer reports that the extra handling of the plants appeared to have spread mosiac disease in these plots. Also, the sudden cessation of the rains did not allow of full development in tobacco fertilised after planting, so that experimental results were adversely affected.

Although planting conditions were good, exceptionally prolonged rain, with low temperatures and little sunshine in the early part of the season, inhibited the growth of tobacco and made the task of establishing a good uniform stand very difficult. Retarded growth caused the plants to flower low and when the rains ceased abruptly in the middle of January, certain plantings had no opportunity for further development. In some experiments, therefore, climatic conditions so dominated plant growth that the effects of various treatments were completely masked.

Part of Pathology Laboratory.

The rainfall for the year was as follows:—

TABLE I.

Rainfall on the Tobacco Research Station, Trelawney.

Month.	No. of days rain.	Largest fall.	Total.
1934—			
November	17	20th .87	5.53
December	19	18th 2.05	10.65
1935—			
January	18	10th 2.05	11.05
February	8	9th .43	1.70
March	8	17th .66	1.80
April	2	24th .50	.53
May	4	15th .30	.54
June, July	—	— —	—
August, September	—	— —	—
October...	5	30th .42	.68
November	6	22nd .62	1.14
December	14	20th 1.82	4.70
Total	101		38.32
Total for year 1935	65		22.14

The unfavourable nature of the precipitation may be assessed from the following table.

TABLE II.

Incidence of Rainfall during the Season 1934-35.

Period.	No. of days rain.	Precipitation in inches.
13-27th November	13	4.96
3-18th December	14	8.95
27th December-23rd January	22	12.72
Total		27.23

During the periods shown the sky was generally overcast and little or no sunshine was observed on many days. It will be seen that out of a total precipitation of 30.73 inches

for the season, 27.23 inches fell before January 23rd, and only 3.50 inches during the remaining two months of the growing season.

For the purpose of field experimentation, tobacco is an extremely difficult crop with which to deal. Climatic factors so influence plant development that failure to obtain significant results is not uncommon. It appears, therefore, to be necessary to modify the technique at present employed in field trials, and future research will be designed with this object in view.

The crop, generally, was almost free from disease, and formed a contrast to the commercial crops in the Trelawney district. A slight infection by frog eye (*Cercospora nicotianae*) was experienced, but was eradicated by the usual priming method. Angular spot made an unexpected appearance on a few plants in one land, but this was also eliminated by prompt priming and spraying with bordeaux mixture.

The freedom from disease of the cured crop can be attributed to planting on a new farm, thorough and frequent spraying of seed-beds and the prompt application of control measures in the lands, on the first appearance of disease.

Little trouble was experienced from insect pests, although some loss was occasioned by wireworms, crickets and grasshoppers. At the close of the season, plant roots were examined for eelworm, but no symptoms were observed.

Very difficult planting conditions were experienced in the 1935-36 season. No planting rain fell until November 22nd, and then only a litte over half an inch was registered. Two subsequent days were dull and overcast with drizzle, which allowed of a number of plots being planted. Very hot dry weather then set in and no rain fell until December 10th, so that it was impossible to refill the planted lands and a somewhat uneven stand resulted owing to losses from drought and crickets.

No general rains had set in by the end of the year and the hot dry weather precluded the possibility of uniform stands.

By the end of December, light rains interspersed with bright sunshine, had filled out the early plantings satisfactorily, and even the late plantings, which were at one time very backward, were making rapid growth, but it is anticipated that results from field trials will be compicated by the number of missing plants per plot and the irregularity in stand.

Farm Work and Development.—Fifty acres of new land were stumped and cleared and 600 yards of storm drains cut. Forty-six acres of second year land were ploughed and prepared for planting. Approximately 2,500 yards of seed-beds were laid out, fenced, screened with grass and burned, necessitating the cartage of 350 loads of brushwood.

One and a quarter miles of new road were stumped, cleared and levelled and approximately 1,000 yards of trench were dug and piping laid for the water supply system. The sites of the married quarters, single quarters, laboratory, barns, grading shed and curing chambers were stumped and cleared and approximately 370,000 bricks carted for the contractors. In addition, 297 loads of wood were cut and carted for burning the brick kilns. This work was undertaken in order to accelerate the erection of the buildings, which were urgently required to accommodate the newly appointed staff, and severely taxed the labour supply available for maintenance and development. As a result, the tree planting programme had to be curtailed and the execution of a scheme for the lay-out of the Station had been retarded.

Owing to the scarcity of grazing, it was found necessary to cut and stack eight tons of hay and make 60 tons of maize and bean ensilage. A paddock of 30 acres in extent was also fenced and mown twice.

At the end of the year 27 acres had been planted to tobacco, a further 13 acres prepared for planting this season, and 22 acres of check-row maize and five acres of other crops sown.

Owing to the poor condition of the cattle as a result of the exceptionally cold winter and being newly arrived in the district, it was necessary to use the motor lorry for the transportation of a considerable amount of material from the

railway siding. In addition to normal stores, it was necessary to convey cement, flue pipes and fittings for the barns and curing chambers, and the personal effects and furniture of the resident staff. Consequently much of the Foreman's time was occupied in driving the lorry.

Research.—For the purposes of organisation the research staff has been grouped as follows:—

Plant Breeding ...	Mr. Moffett	Mr. Smith, Lay Assistant.
Plant Physiology	Mr. Thorpe	
Tobacco Agronomy	Mr. Ellis	Mr. Collins, Lay Assistant.
Pathology	Dr. Hopkins	

PLANT BREEDING.

The work undertaken by Mr. T. K. Sansom, Plant Breeder, in the 1934-35 season was largely a continuation of experiments conducted at Marandellas and Hillside Experiment Stations, and comprised the testing of 16 neawly introduced varieties; further selection of 49 single plant selections from varieties previously grown in Rhodesia; selection from F2 hybrids of crosses between Hickory Pryor x Warne, Hickory Pryor x Cash, Western x Little Crittenden and their reciprocals; selections for smallness of ruffle, and high and low nicotine content; and field trials of 12 different varieties.

Single Plant Selections.—Two selections were made from the progeny of each of the single plant selections picked out this season, and one single plant selection was made from each variety for smallness of ruffle. The plants which gave the highest and lowest nicotine contents were kept from each of four varieties analysed by the Chemistry Branch. Bulk selections were also made from each type and the seed stored for future reference.

Hybrids.—Twelve types were chosen from the F2 and 10 selections made from each type, thus giving 120 selections for planting in the following season.

Variety Trials.—Of the 12 varieties tested, five have given consistently good returns for the past three years. These are White Stem Orinico, Jamaica Wrapper, Cash, Warne and Willow Leaf, and are being retained for further selection. The remainder have been discarded.

Experimental Curing Chambers and part of new Grading Shed.

Part of Seed Beds.

In August, the work was taken over by Dr. A. A. Moffett, Tobacco Plant Breeder, who rubbed out, cleaned and treated all seeds retained, excepting the bulk selections which were not cleaned or treated.

For the 1935-36 season the following programme has been followed.

Sixteen newly introduced varieties from Cuba, Mauritius, Brazil, and Russia, including one reputed to be resistant to mosaic, and selections from 16 varieties introduced last year have been put out for testing, whilst 49 single plant selections have been planted. Selections for nicotine content, smallness of ruffle and plants of *Nicotiana triplex* have also been included. The 120 hybrid selections of flue-cured varieties have been planted in duplicate plots, but the fire-cured hybrids have been despatched to the Experiment Station at Shamva for continuation.

Field Experiments.

The field trials, in charge of Mr. H. F. Ellis, Tobacco Research Officer, were largely a continuation of experiments carried out at Marandellas and Salisbury in previous years, and comprised application of phosphate and potash trials, spacing and topping trials, three-year rotation trials, a comparison of methods of application of fertiliser, and a test of White Stem Orinico seed selected by the Department against seed selected by a commercial grower.

The latter was put down in order to compare it with the selections made in previous years on the Salisbury Station.

The phosphatic fertiliser trial again indicated that the usual commercial application of this constituent is in excess of the requirements of the crop, which appears to be not more than 75 lbs. per acre of 40 per cent. double supers.

Spacing trials also indicated that a change from the normal 3 ft. x 3 ft. would be advantageous on the particular type of soil used. Climatic conditions completely upset the topping trials.

The commercial test showed that the strain of the White Stem Orinico selected by the Department gives slightly finer

textured leaf than that of the commercial variety chosen, although the check variety was probably of a higher standard than that generally grown in the country.

Potassic fertiliser trials again gave obscure results, which showed a wide discrepancy from those obtained in previous years. No consistent results have as yet been obtained with potash, the assimilation of which by the plant appears to be largely controlled by environmental conditions. It seems to be certain that more than one major factor is involved, so that further field trials have been postponed pending a more critical study of mineral absorption under local conditions.

The remaining experiments have yielded indefinite results.

The programme for 1935-36 season has been divided into two parts. (i.) Practical Field Experimentation and (ii.) Preliminary Trials for Physiological Study.

(i.) *Practical Field Experimentation.*—Under this heading are included the following trials. A continuation of the three-year rotation trial commenced last season; the planting of 11 perennial and 7 annual grasses, 15 miscellaneous legumes, ground nuts, and cotton, in order to find which rotation crops are suitable for the district. It is intended to make particular note of grasses suitable for paddocks or grass fallow.

Spacing trials have been extended to cover a wider range than last year, varying the spacing between the plants as well as between the rows.

The topping trials are being repeated and records kept of relation topping to weather and fertilisers.

The method of application of fertilisers is being studied in relation to seasonal conditions and plant growth, as well as to economical methods.

The effect of different methods of seed-bed management on the growth of the subsequent crop is being examined, and an experiment, designed by Dr. M. Nierenstein, to study the effect of subjecting seedlings to ultra-violet radiation under dyed seed-bed cloth has also been laid out.

An experiment has been commenced to investigate the results obtained by different methods of planting.

The phosphate trials are being repeated, but an experiment with grass mulch had, unfortunately, to be postponed owing to the shortage of plants in the seed-beds resulting from adverse weather.

(ii.) *Physiological Experiments.*—Experiments under this heading are designed for the detailed study of the absorption of nutrient materials by the plant.

One experiment is put down for the study of the relation of calcium ion to the assimilation of different forms of nitrogen, a second deals with the effect of time of application of nitrogen throughout the season on plant development and quality of cured leaf, whilst the third, which was prepared in co-operation with the Chief Chemist, aims at following the availability curve of nitrogen by means of modified lysimeters.

Pathology.

No laboratory facilities being available during the year under review, detailed work in pathology could not be attempted. Furthermore, the time of the Senior Plant Pathologist was almost entirely occupied with administrative duties in connection with the development of the Station.

It was, however, possible to carry out field spraying trials on a commercial scale, and for that purpose suitable spray equipment was prepared.

Late in the year, at the request of the Rhodesia Tobacco Association, it was decided to continue the investigations into the nematode problem which had been carried on for a number of years on the Salisbury Station, and a project was drawn up, in co-operation with the Chief Entomologist, to be carried out on the neighobouring farm of Mr. Biljon, who leased an area of 10 acres of infected land to the Tobacco Research Board. Mr. Collins, Lay Assistant, is carrying out this work. Thanks are due to Mr. Biljon for assistance rendered to the research staff.

Curing.

For the purpose of the scientific study of the processes of curing, a block or three special chambers, measuring 6 ft. x 6 ft. x 8 ft., was designed by the Irrigation Branch and is now erected. These chambers are heated by steam, have hot and cold ventilation, the area of which can be measured will have mechanical air circulation, and are fitted with recording thermographs and hydrographs. It was hoped to include in the equipment thermostatic and hydrostatic control, but funds were not available this year for the purchase of the necessary instruments.

In addition to this, experiments are planned with coal furnaces, a new type of wood furnace, methods of insulation and air circulation, variations in flue design and study of the rate of loss of heat by the gasses in traversing the flues.

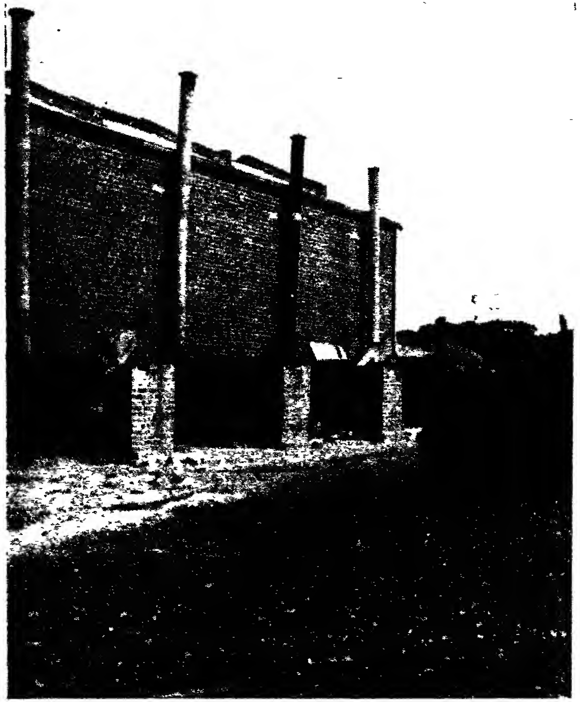
Arrangements have been made for keeping accurate records of fuel consumption during these experiments.

Miscellaneous.—The Tobacco Research Board paid two visits to the Research Station during the year.

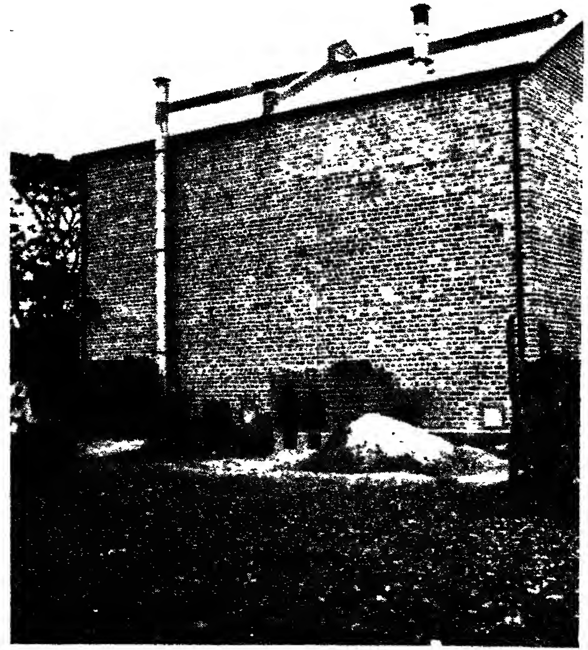
The Senior Plant Pathologist attended five meetings of the Board by invitation.

Buildings.—At the end of the year the erection had been completed of the Senior Plant Pathologist's house, the grading shed, barns and curing chambers, but the junior single quarters and laboratory were still incomplete, and no start had been made on the electric plant and power house.

Among the visitors to the Station were Dr. W. Small, Director of Agriculture, Nyasaland; Mr. C. J. Lewin, Secretary of Agriculture, Northern Rhodesia; Dr. C. W. B. Arnold, of the Imperial Tobacco Company, Nyasaland; Mr. A. C. Henderson, Mr. W. J. Field, Mr. J. Reid Rowland, and members of the Banket Farmers' Association.



Original Gundry furnaces heating small barns.



Improved Gundry wood furnace and coal furnace on commercial barns. Note inside chimney in latter.

Annual Report of the Division of Forestry.

FOR THE YEAR 1935.

By E. J. KELLY EDWARDS, M.A., Dip. For. (Oxon.),
Chief Forest Officer.

The most noteworthy event of the year under review was the visit of and report by Mr. C. E. Legat, late Chief Conservator of Forests for the Union of South Africa, on the suitability of the Stapleford Forest Reserve for afforestation with softwoods. In 1932 an unsolicited adverse report was submitted to Government from a source unacquainted with forestry and ecology. The report caused widespread concern, and although the Government finally abided by the assurance of its forest officers, a certain uneasiness remained. To remove or confirm these doubts Mr. Legat was asked to report to Government. The report was completely reassuring, and while the Forest Service is naturally pleased at its vindication, there is a deeper pleasure in the knowledge that the general public can have confidence in State forestry.

The Fourth Empire Forestry Conference was attended by the writer during all its sessions and visits in the Union of South Africa. It is perhaps unnecessary to state that great benefit was derived from the Conference from the point of view of Empire Forestry, but from the parochial aspect the Conference was of peculiar value to Southern Rhodesia, as she has many forest problems in common with the Union. The solution of some of these problems already found by the Union with its longer experience will save this Colony from much duplication in research.

The Conference served a further useful purpose to this Colony by requiring a stock-taking of her forest resources. The results of this overhaul brought to light some very unpalatable facts, foremost of which is that Southern Rhodesia is expending her accessible forest capital at the rate of more

than 24 million cubic feet of timber per annum. This unhappy state of affairs is due partly to the march of progress, partly to the inability of the increment of most types of indigesous vegetation to keep pace with consumption, but mostly to wasteful utilisation and the ravages of fire.

The actual field operations of the Service at Mtao, Stapleford and in the indigenous forests of the Kalahari sand areas have been eminently satisfactory, so much so that, in many respects, 1935 may be considered our most successful year.

At Mtao, where the main difficulty lies in tiding young plants through their first two years of life, extra care in soil preparation has given marked success in the plantings of the last three years in spite of the fact that the rainfall for this period has been 23 inches under normal. Revenue from sale of timber was double that of the previous year.

At Stapleford topographical surveys are well in hand and the consolidation of all stands as regards planting operations is now complete. The serious rat damage, mainly to cypresses, annually recorded in the past, is now largely obviated by systematic clearing of clumps of indigenous vegetation and by eliminating the cover grass, *Eragrostis grandis*.

Of the Kalahari Sand Areas it is pleasing to record that, for the first time since the inception of fire protection operations in 1925, no fires occurred during 1935 in the protected area of 405,540 acres. This was due to the extension of the fire guard system, to the better organisation of fire-fighting units, and to extensive patrols carried out by the European and native staff.

In the Gwaai Forest Reserve of the Kalahari Sand Areas a working plan survey was commenced and approximately 2,000 areas were enumerated. A valuation survey of 7,500 acres of Crown land in this vicinity was also carried out.

Valuation surveys carried out in recent years, together with observations on the exploitation by timber concessionaires, have shown that the accessible supplies of Umgusu (*Baikiaea plurijuga*) have been seriously overcut. To maintain sustained supplies of this so-called "Rhodesian Teak" it will be necessary to regulate the annual or periodic supplies.

Further to safeguard future supplies steps should be taken to create and maintain forest reserves on certain Crown lands in the Kalahari Sand Areas which are unfit for purposes other than timber production.

Towards the close of the year the administration of the Rhodes Inyanga Estate was placed under the control of this Division. The policy of the Government is to popularise this huge estate in the mountain highlands of Southern Rhodesia as a health and leisure resort for the people of this Colony. To this end the system of roads and paths embracing spots of scenic or historic interest will be extended, the stocking of numerous streams with trout will be continued, and a series of rest camps for the holiday camper will be established. In addition to this main programme experimental fruit planting and afforestation on a small scale will be carried out.

The position with regard to European unemployment relief in forestry has been very satisfactory throughout the year. At Stapleford Camp the number of men employed was never higher than 25, and for the latter part of the year the average was as low as 13, and for a brief period the number even dropped to nil.

The Chaka Nurseries, maintained for elderly men at Mtao, functioned very smoothly throughout the year. On an average there were 42 men in employment. The system of appointing Welfare Officers to the charge of these camps is proving very satisfactory.

The writer again has pleasure in paying a tribute to the loyal co-operation of his staff.

A summary of the year's work at the various stations is as follows:—

(1) **Salisbury Forest Nursery.**—During the year 415 cubic feet of timber, 160,169 young trees, 38,587 hedge plants, 26,004 shrubs and 1,162 lbs. of seed were sold.

Revenue, which has improved by £205 over the previous year, totalled £2,058, inclusive of an amount of £705 made up of free issues.

The value of free issues indicates the importance of the nursery in supplying Government institutions throughout the Colony with trees, hedge plants, shrubs and seed.

A change over from mule to motor transport was effected.

One thousand and seventy-three persons visited the Nursery during the year.

(2) **Mtao Forest Reserve.**—Two patrols, Fairfield and Midfield, were maintained throughout the year. The Chaka Nurseries, situated in the Midfield patrol, raised some 600,000 transplants for use on the Reserve.

The usual fire protection operations were successful and no fires occurred. Drought has caused severe losses in experimental stands of *Pinus pinaster*, *Cedrela toona*, *Jacaranda mimosaefolia*, *Melia azedarach*, *Widdringtonia whytei*, and *Eucalyptus dalrympleana*.

The rainfall for the year was only 15.61 inches.

During the past six years there has been a shortfall of 27.19 inches compared with the period 1924-29.

One hundred and thirty-seven acres were planted and 17 acres re-planted. The total area under plantations is now 1,713 acres.

Twelve thousand eight hundred and twenty cubic feet of timber were removed from plantations and 4,850 cubic feet were sold.

Cash revenue for the year amounts to £286 2s. 7d.

(3) **Stapleford Forest Reserve.**—Topographical surveys were continued and an area of approximately 1,830 acres was covered during the year.

The usual fire protection operations were carried out. No fires occurred in the Reserve.

Rodent destruction showed a steady decrease and, in fact, had practically ceased when a young stand of *Pinus longifolia* was attacked in November. From observations it appears that rodent damage will not occur once the grass *Eragrostis grandis* has been cleared. Other weeds, particularly many species of *Helichrysum*, and clumps of indigenous vegetation must also

be kept down. The attack on the *Pinus longifolia* is attributed to clearing operations in an adjoining area. It is interesting to note that hawks were present in great numbers during these clearing operations.

Frosts were severe and seriously affected two exotic species in the arboretum, *viz.*, *Eucalyptus naudiniana* and *Acrocarpus fraxinifolius.*

Nine hundred and thirty acres were blanked.

Four hundred and fifteen acres of new plantings were completed, bringing the total area of plantations to 3,424 acres.

One hundred and fourteen yards of road and 20,017 yards of paths were constructed in the Reserve and existing roads and paths maintained.

European labourers constructed 413 yards of external roads.

New foreman's quarters were erected by the Public Works Department.

Nine thousand trout ova were received. The hatching was 90 per cent. successful.

(4) **Kalahari Sand Forests.**—Working plan data were collected for Gwaai Forest Reserve, and a valuation survey of certain Umgusu ("Rhodesian Teak") forests on Crown lands was carried out. The valuation surveys which have recently been undertaken by this Division again make it apparent that, unless protected from repeated fire damage, once very valuable stands of timber are being rendered almost unexploitable.

Protected areas were regularly patrolled.

Thirty-two miles of new lines were demarcated, 64 miles of new lines were cleared of all tree and shrub growth, 405 miles of fire lines mainly 15 feet wide were cleared, 490 miles scoffled and 291 miles by an average width of 50 yards were burnt.

Control burning experiments were carried out. It is most pleasing to be able to record that despite dry conditions no fires occurred in, or entered, protected areas totalling 405,450 acres.

Preliminay results from sample plots laid out in Gwaai Forest Reserve reveal the following tentative girth increments per annum of the main species:—

Baikiaea plurijuga	0.5 inches.
Copaifera coleosperma	0.5 ,,
Pterocarpus angolensis	0.8 ,,
Ricinodendron rautanenii	1.4 ,,

An isolated specimen of *Baikiaea plurijuga*, when measured during November, 1921, had a breast height girth of 23.50 inches. When measured during August, 1935, the girth at breast height was 39.10 inches. An isolated *Pterocarpus angolensis* measured at the same time has increased from 29.50 inches breast height girth to 55.60 inches breast height girth.

Messrs. Rhodesia Native Timber Concessions continued to exploit "Umgusu" (*Baikiaea plurijuga*) forests in the Wankie and Nyamandhlovu districts.

New quarters were in course of construction by the Public Works Department for the District Forest Officer. New quarters for the Forester in Charge of Gwaai Forest Reserve were completed and occupied early in the year.

As a result of protection many classes of game showed an increase during the year.

A provisional check list of 220 trees asd shrubs occurring in these areas was compiled.

(5) **Wankie Game Reserve.**—The year under review, like the preceding five years, has been one of unsatisfactory rainfall. The insufficient rainfall, resulting in water supplies being below normal, caused a decline in the numbers of game in the Reserve. Some progress has, however, been made with the improvement of water supplies and further and more extensive operations are anticipated during 1936.

General patrol work has been hampered by more urgent duties, most of which were in connection with the operations of a drilling machine during the early part of the dry season and occupied that portion of the year during which patrols and road making are mainly carried out.

The extending of the road system was not commenced until July and the shortage of water along the route necessitated the work being somewhat rushed and consequently not done as thoroughly as was desired.

The demarcation of the boundaries of an adjoining farm has been undertaken.

Ten natives attested as special native constables were employed to patrol mainly the northern and eastern boundaries of the Reserve, although portions of the southern and western boundaries have also been patrolled.

The Reserve suffered very little from fire damage. It is estimated that not more than 5 per cent. of the area was traversed by fire.

Locust invasions were not serious and no deposition of eggs has been recorded.

The existing 80 miles of roads were maintained and 64 miles of new roads constructed.

Eland have again been scarce and the large herds which were noted four to five years ago seem to have disappeared.

Where elephants were in small herds of about a dozen individuals it was noted that in each group there were frequently characteristics not noted in other groups, *e.g.*, one small herd was noted to have remarkably straight tusks which pointed downwards, whereas another small herd consisted mainly of animals with no tusks. It is therefore considered reasonable to suppose that the members in each small herd may be related. In most cases these small herds were not accompanied by old bulls.

Elephant calves have been frequently seen, and on one occasion twin calves were observed.

Five dead elephant were found in the Reserve during the course of the year. This is the largest number found dead in any one year since the inception of the Reserve. There were no indications of the cause of death.

Gemsbok and giraffe were present in their usual numbers.

Two Cape hartebeeste were observed near Kennedy Halt during September.

The number of sable and roan in the Reserve has been seriously reduced during the last few years and very few herds of more than 10 to 12 have been seen.

Wildebeests seem to be appearing in gradually increasing numbers.

Lion and spotted hyenas appear to be decreasing in numbers.

Extremely severe frosts during the winter seemed to kill much of the insect life. This resulted in insectivorous birds adopting somewhat unusual habits. For example, the Fork-tailed Drongo would follow a human being or animal for many miles and collect any insects disturbed in the vegetation.

Two Sacred Ibis were present up to mid-July. This is the first time the presence of these birds has been recorded for this Reserve.

A baby elephant abandoned by its mother was captured and every endeavour made to rear it. However, after being in captivity for a month it died from lung trouble.

The natural water supplies were on the whole very poor. A windmill erected over a borehole in September maintained the level of water on Ngwashla Pan. The water supply maintained by the windmill near the Homestead again proved to be a very valuable asset. Conditions were greatly improved when rain fell in December.

No serious poaching took place during the year, and the only cases which occurred resulted in convictions.

With a view to introducing fish into pans when these are provided with windmills, 25 bream and other fish were introduced into the Homestead windmill pool and in one year increased to approximately 400. Game, however, fouled the water to such an extent that all except three catfish died.

There were not many visitors to the Reserve during the year. As water and game were scarce the Game Warden advised a number of intending visitors against visiting the Reserve.

One Wooden hut was added to the three already in existence at the Rest Camp.

(6) **Victoria Falls Reserve.**—The usual maintenance of paths and walks was carried out, and fresh vistas opened in the Rain Forest and along the river.

Extensive anti-malarial work was done by the Railway Administration.

Large numbers of tourists visited the Reserve and the camping area was well patronised.

Game appear to be on the increase in the Reserve and the adjoining Game Reserve.

(7) **General Summary.**

Station.	Area planted 1935. Acres.	Total area planted to date. Acres.	Expenditure, exclusive of emoluments.	Revenue, including free issues.
Salisbury Forest Nursery	—	44	£798 0 5	£2,058 2 1
Mtao Forest Reserve... ...	137	1,714	1,349 10 3	288 7 7
Stapleford Forest Reserve	415	3,424	2,298 9 8	19 14 6
Kalahari Sand Areas	(405,450 acres protected).		1,177 4 5	3,210 17 10
Wankie Game Reserve ...	Patrolled		627 2 6	—
Victoria Falls Reserve ...	Maintained		133 12 8	—
Totals	552	5,182	£6,383 19 11	£5,577 2 0

(8) **Private Forests.**—During the year 29 private estates and 11 schools were visited and advice given by Forest Officers. Addresses were given to two meetings of Farmers' Associations.

Available statistics show that the area under private plantations in 1935 was 18,577 acres.

(9) **Forestry in Native Reserves.**—The Forest Officer employed by the Native Reserves Trusts made preliminary reconnaissances in eight reserves and interim inspections in seven reserves during the year, bringing the total of reserves inspected since 1933 up to forty.

He reports that the consumption of timber is being maintained at the former high level. Conservation and full utilisation of existing timber resources are of primary importance to enable the future timber requirements of the native inhabitants of the reserves to be met. Afforestation is also necessary. In certain reserves the native inhabitants have undertaken tree planting on a minor scale on their own initiative, and the Forest Officer urges that all such attempts should be encouraged.

Fire protection measures have been successfully initiated in the valuable Umgusu forests occurring in north-western Matabeleland, and, during the year, 22,000 acres of Umgusu regeneration were protected in the Gwaai Native Reserve.

(10) **Research and Investigation.**—Valuable ecological data were collected and the Division expresses its gratitude to the Imperial Forestry Institute and Kew for determinations of botanical specimens.

Logs of *Eucalyptus citriodora*, *E. globulus* and *E. maculata* were despatched to the Forest Products Research Institute, Princes Risborough, to be tested with a view to ascertaining their suitability for the manufacture of tool handles. No report has yet been received. It has, however, been intimated that owing to spiral grain the *E. globulus* logs were unsuitable for test purposes.

Experiments were commenced to ascertain the durability of Eucalypts of pole size treated with zinc chloride and sodium arsenite.

(11) **Publications.**—During the year a statement on "Forestry in Southern Rhodesia" was prepared by the writer for the Fourth Empire Forestry Conference held in the Union of South Africa and two articles were contributed to the local Press.

Administration.—During the year the staff of the Division comprised the Chief Forest Officer, 4 District Forest Officers, 1 Manager, 7 Foresters, 3 Foremen Foresters, 1 Apprentice Forester, 1 Game Warden, 1 Curator and 1 Clerk.

The apprentice forester resigned at the end of the year.

Southern Rhodesia Weather Bureau.

MAY, 1936.

Rainfall.—The mean barometric pressure over the whole country was approximately 1 millibar below normal.

Temperature.—The mean monthly temperature was variable, but about normal on the whole.

Weather.—Approximately average rainfall was experienced, most of it falling in the first few days of the month.

MAY, 1936.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Normal.	Temperature in Stevenson Screen °F. Absolute. Max.	Min.	Mean. Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation. Ins.	Normal	No. of Days	Altitude (Feet)
Angus Ranch... ...	...	...	89	42	76.9	55.1	66.0	65.4	65.6	60.0	72	56	...	0.41	0.19	4	...
Beitbridge...	967.8	...	97	37	79.5	53.2	66.3	...	63.2	57.1	69	53	...	0.51	0.44	3	1,500
Bindura...	894.1	..	82	38	75.8	52.2	64.0	..	62.1	56.4	70	52	2.8	0.19	0.57	3	3,700
Bulawayo	870.9	872.0	82	33	71.2	47.9	59.6	61.1	58.7	53.4	76	49	4.3	0.94	0.35	3	4,426
Chipinga	894.9	...	84	42	69.9	52.9	61.4	...	62.2	56.6	73	54	3.7	1.02	0.97	10	3,685
Enkeldoorn...	859.7	...	82	38	71.1	49.6	60.4	60.9	59.5	53.5	69	49	3.1	0.28	0.30	2	4,788
Fort Victoria	898.2	899.6	86	34	73.0	49.4	61.2	59.9	59.4	54.7	74	51	3.7	0.32	0.33	6	3,571
Gwaai Siding	906.5	...	84	30	78.6	48.9	63.8	...	59.8	54.6	71	51	2.5	0.85	...	2	3,278
Gwanda...	909.0	...	86	34	74.2	50.9	62.6	...	60.2	55.0	72	51	4.2	0.47	0.30	5	3,233
Gwelo	864.7	...	84	34	72.1	48.7	60.4	60.8	58.9	53.3	69	49	4.1	0.07	0.32	2	4,629
Hartley...	887.9	...	83	34	75.2	48.8	62.0	63.4	61.1	55.8	71	52	1.8	0.08	0.32	2	3,879
Inyanga...	838.8	...	79	33	70.1	44.9	57.5	...	60.0	52.5	61	47	1.9	0.51	0.59	3	5,503
Marandellas	839.5	...	76	38	67.9	49.1	58.5	...	57.5	52.1	70	48	3.0	0.61	0.64	3	5,453
Miami	881.2	...	83	41	74.0	51.9	62.9	...	62.5	57.2	72	54	3.3	0.25	0.03	3	4,090
Mount Darwin ...	910.0	...	84	37	78.0	50.2	64.1	..	64.6	59.4	74	56	3.1	...	0.51	...	3,179
Mount Nuza	803.2	...	67	34	57.5	44.5	51.0	...	51.2	47.6	78	45	5.1	1.76	...	11	6,668
Mtoko	879.7	...	83	44	75.5	53.5	64.5	...	64.2	57.3	66	52	1.7	0.19	0.37	1	4,141
New Year's Gift..	...	...	90	43	76.3	52.5	64.4	...	60.7	56.5	78	53	...	0.37	0.53	5	2,690
Nuanetsi	965.8	...	94	37	79.3	51.4	65.3	...	64.9	60.3	77	58	2.9	0.50	0.33	4	1,581
Plumtree	866.7	...	81	39	71.2	51.2	61.2	..	58.9	53.0	67	48	2.1	1.54	0.69	4	4,549
Que Que	884.4	...	85	37	75.2	50.2	62.7	..	60.7	54.9	69	51	3.4	0.49	0.22	2	3,999
Rusape	864.6	...	81	33	70.8	48.0	59.4	...	57.5	53.7	79	51	3.2	0.83	0.27	7	4,648
Salisbury	855.8	857.8	80	37	72.9	49.2	61.1	61.0	61.6	54.9	65	49	2.2	0.42	0.46	5	4,885
Shabani...	913.1	...	88	39	74.8	52.6	63.7	...	62.4	57.4	74	54	4.4	0.46	0.54	5	3,131
Sinoia	890.8	...	84	34	77.4	48.1	62.7	...	62.2	56.3	69	52	1.5	0.92	0.35	4	3,795
Sipolilo	887.6	...	82	37	75.9	51.0	63.5	...	64.3	57.0	64	52	2.2	0.15	0.38	3	3,876
Stapleford	844.1	...	74	27	64.6	41.8	53.2	...	54.9	52.5	86	51	3.7	2.00	1.26	10	5,304
Umtali...	895.4	896.5	87	41	74.0	51.3	62.6	62.6	61.4	57.2	78	54	3.2	1.14	0.49	9	3,672
Victoria Falls... ...	...	...	...	...	...	...	...	...	...	...	...	...	..	2.24	0.43	2	3,009
Wankie	929.9	...	90	48	83.6	58.7	71.2	...	65.9	58.2	62	53	2.0	0.05	0.81	1	2,567

Southern Rhodesia Veterinary Report.

APRIL, 1936.

AFRICAN COAST FEVER.

Disease was diagnosed at Tshazabukwa dip tank, in the Matopo Hills, and on farm Malaje, in the Matopo Native District.

MALLEIN TEST.

Thirteen horses and twelve mules were tested upon entry. No reaction.

TUBERCULIN TEST.

Nineteen bulls and eleven cows were tested during the month with negative results.

IMPORTATIONS.

From the Union of South Africa.—19 bulls, 13 horses, 12 cows, 12 mules, 3 pigs, 1,970 sheep.

From Bechuanaland Protectorate.—702 sheep.

EXPORTATIONS.

To Portuguese East Africa.—Two donkeys.

EXPORTATIONS—MISCELLANEOUS.

Meat Products.—From Liebig's Factory.—Meat extract, 18,570 lbs.; beef powder, 122,238 lbs.; beef fat, 50,000 lbs.; meat meal, 74,000 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-36.

Monthly Report No. 42. May, 1936.

During May the Red Locust (*Nomadacris septemfasciata*, Serv.) has been present in the Colony mainly in the hopper stage.

The following districts have included hopper infested localities, namely:—Chibi, Mazoe, Salisbury, Hartley and Charter. Hoppers were present up to the end of the month in some localities.

From the 19th flying swarms were reported in the districts of Mtoko, Ndanga and Chibi—the first mentioned swarms having come from Portuguese East Africa.

Every effort has been made to reduce the hoppers to a minimum in all accessible localities, and few winged swarms are expected to develop within the Colony.

On the whole, the outlook is very hopeful. The present swarm cycle of the species appears to be at a low ebb in this part of Africa.

RUPERT W. JACK,
Chief Entomologist.

Departmental Bulletins.

The following Bulletins are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

N.B.—The date the article appeared in the Journal is indicated in abbreviated form before the number, e.g., 8/22, No. 429, means that Bulletin 429 appeared in the Journal for August, 1922.

AGRICULTURE AND CROPS.

3/31. No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

4/31. No 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

5/31. No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

9/31. No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

10/31. No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

11/31. No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

12/31. No. 837. Veld Grass Silage: A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.

1/32. No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulip Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B V.Sc., Veterinary Research Officer

6/32. No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.

8/32. No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.

2/33. No. 878. A.I.V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.

11/34. No. 936. Witchweed, by S. D. Timson, M.C. Dip.Agric. (Wye), Assistant Agriculturist.

10/35. No. 970. Rhodes Grass for the Southern Rhodesian Tobacco Grower, by African Explosives and Industries, Ltd.

11/35. No. 972. Notes on Witchweed, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

2/36. No. 978. Organic Manure in Relation to Wheat Growing in Rhodesia: Its Importance and How to Produce It, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

3/36. No. 982. Weeds: Control of Weeds on Footpaths and Tennis Courts, by S. D. Timson, M.C., Assistant Agriculturist

6/36. No. 992. Annual Report of the Agriculturist for the year 1735, by D. E. McLoughlin, Agriculturist.

REPORTS ON CROP EXPERIMENTS.

7/27. No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

4/28. No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

7/29. No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

7/30. No. 789. Agricultural Experiment Station, Salisbury. Annual Report of Experiments, 1928-29, by H. C. Arnold.

9/31. No. 830. Salisbury Agricultural Experiment Station, Annual Report, 1929-30, by H. C. Arnold, Manager.
10/32. No. 864. Annual Report, 1930-31: Agricultural Experiment Station, by H. C. Arnold, Station Manager.
6/33. No. 895. Salisbury Agricultural Experiment Station Annual Report, 1931-32, by H. C. Arnold, Manager.
3/34. No. 914. Gwelo Municipal Demonstration Station: Final Report, 1933, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
9/35. No 965. Salisbury Agricultural Experiment Station Annual Report, 1933-34, by H. C. Arnold, Manager.

TOBACCO.

8/26. No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
9/26. No. 615. The Culture of Virginia Tobacco in Southern Rhodesia: Field Management, by D. D. Brown.
5/27. No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.
5/27. No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
9/27. No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad)
11/27. -No 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
1/28. No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
2/28. No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
12/28. No. 715. Turkish Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.
3/29. No. 728. Suggested Crop Rotations for Tobacco Growers, by D. D. Brown, Chief Tobacco Expert.
4/29. No. 734. Common Faults in Curing Virginia Bright Tobacco, by D. D. Brown, Tobacco and Cotton Expert.
8/29. No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
9/29. No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
2/30. No. 771. Dark Fire-cured Tobacco: Field Operations, by D. D. Brown, Chief Tobacco Expert.
3/30. No. 774. Dark Fire-cured Tobacco: Harvesting and Curing, by D. D. Brown, Chief Tobacco Expert.
6/30. No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
3/31. No. 812. Selection of Tobacco Seed Plants, by H. F. Ellis, M.Sc., B.S. (Agric.), Tobacco Adviser.
9/31. No. 828. Seed Beds, by D. D. Brown, Chief Tobacco and Cotton Expert.

11/31. No. 835. Tobacco Culture: Transplanting Operations, by D. D. Brown.
3/32 No. 846. Leaf Curl in Tobacco, by Dr. H. H. Storey.
3/33. No. 885. Tobacco Culture in Southern Rhodesia: The Harvesting and Curing of Virginia Tobacco, by D. D. Brown, Chief Tobacco Officer.
12/34. No. 941. A New Type of Tobacco Furnace, by B. G. Gundry, A.I Mech.E.

LIVE STOCK.

1/27. No. 624. The Construction of Dipping Tanks for Cattle (Revised).
6/30. No. 785. Bacon Curing on the Farm, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
1/31. No. 801. Sheep Farming in the Melsetter District, by J. C. Kruger, Part-time Sheep Adviser in the Melsetter District.
3/32. No. 845. The Raising of Bacon Pigs, by Dr. A. E. Romyn, Senior Animal Husbandry Officer; C. A. Murray, Lecturer in Animal Husbandry, Matopos School of Agriculture, and D. A. Lawrence, Veterinary Research Officer.
10/32. No. 863. Piggeries, by B. G. Gundry, A.I.Mech.E.
12/32. No. 871. Some General Observations on the Feeding of Dairy Cows on a Mixed Stock Farm, by Dr. A. E. Romyn, Senior Animal Husbandry Officer.
1/33. No. 873. The Hand-rearing of Calves, by C. A. Murray, B.Sc. (Agric.), M.Sc.
4/33. No. 887. The Type of Chiller Steer required for Export, by A. E. Romyn, Senior Animal Husbandry Officer.
5/33. No 891. Fattening Bullocks for Export, by A. E. Romyn, Senior Animal Husbandry Officer.
9/33. No. 903. The Handling, Preparation and Chilling of Cattle for Export, by C. A. Murray, Lecturer in Animal Husbandry.
12/33. No. 907. The Blackhead Persian: Its Breeding and Management in Matabeleland, by C. A. Murray, M.Sc., Lecturer in in Animal Husbandry, Matopo Estate.
1/34. No. 909. Stall Fed Chillers for the Overseas Christmas Market, by C. A. Murray, M.Sc., Animal Husbandry Officer, Matopo School of Agriculture and Experiment Station, Rhodes Matopo Estate.
2/34. No. 912. Economical Winter Rations for Wintering Dairy Heifers, by C. A. Murray, M.Sc. (Agric), Lecturer in Animal Husbandry, Matopo School of Agriculture.
4/34. No. 916. Cowpea Hay in the Ration for Bacon Pigs, by C. A. Murray, M.Sc. (Agric.), Lecturer in Animal Husbandry, Matopo School of Agriculture and Experiment Station.
5/34. No. 919. Saltbush: A Winter Succulent for Sheep in Matabeleland, by D. G. Haylett, M.Sc., Ph.D., Director, Matopo School of Agriculture.

6/34. No. 924. Raising Dairy Calves on a Limited Amount of Whole Milk, by C. A. Murray, M.Sc., Agr., Animal Husbandry Officer, Matopo School of Agriculture and Experiment Station, Rhodes Matopo Estate.

1/35. No. 943. Cattle Improvement and a Cattle Breeding Policy in Southern Rhodesia: A Review of the General Position Chiefly as regards Ranching Cattle, by Dr. A. E. Romyn, Chief Animal Husbandry Officer.

1/35. No. 944. Pig Feeding Demonstration: The use of Balanced and Unbalanced Rations for Growing Pigs, by C. A. Murray, M.Sc. (Agr.), Senior Animal Husbandry Officer I/C., Matopo School of Agriculture and Experiment Station.

1/35. No. 945. A Home-made Cow Stanchion, by Major R. R. Sharp, Whinburn, Redbank.

3/35. No. 946. Economical Rations for Wintering Dairy Cattle, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Matopo School of Agriculture and Experiment Station.

5/35. No. 952. Annual Report of the Chief Animal Husbandry Officer for the year ending 31st December, 1934, by A. E. Romyn, Chief Animal Husbandry Officer.

7/35. No. 959. The Selection of a Dairy Bull, by A. E. Romyn, Ph.D., Chief Animal Husbandry Officer.

3/36. No. 981. The Dehorning of Cattle intended for Slaughter and Export, by B. A. Myhill, Assistant Chief Veterinary Surgeon.

4/36. No. 984. Report on the Curing of Rhodesian Hides, by Advisory Committee on Hides and Skins of the Imperial Institute.

4/36. No. 985. Export of Frozen Porkers. Third Consignment to Smithfield. Division of Animal Husbandry.

5/36. No. 987. The Curing of Hides and Skins on the Farm, by The Division of Animal Husbandry.

5/36. No. 988. Preparing Cattle for Show, by The Animal Husbandry Division.

6/36. No. 989. The Supplementary Feeding of Mineral and Protein Supplements to Growing Cattle in Southern Rhodesia and its Relation to the Production of Beef Steers, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate; A. E. Romyn, Ph.D., Chief Animal Husbandry Officer, Department of Agriculture, Southern Rhodesia; D. G. Haylett, Ph.D., Director, Rhodes Matopo Estate; F. Ericksen, Dip. Agric., Experimentalist.

DAIRYING.

1/28. No. 667. Farm Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.

3/29. No. 730. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.

12/30. No. 799. The Objects of Ripening Cream for Butter-making, and a few Hints on Cream Production, by F. Lammas, Dairy Officer.
4/31. No. 818. Farm Butter-making. Issued by the Dairy Branch.
9/32. No. 862. Cream Cheese, by F. A. Lammas, Dairy Officer.
3/33. No. 880. Dairy Tests and Calculations, by F. A. Lammas, Dairy Officer.
5/34. No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by G. B. Gundry, A.I.Mech.E.
7/34. No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.
12/34. No 937. Gouda or Sweet Milk Cheese, by F. Lammas, District Dairy Officer.
2/36 No. 977. Notes on the Feeding of Dairy Cows during the Summer Months, by A. E. Romyn, Chief Animal Husbandry Officer.
6/36. No. 990. Southern Rhodesia Milk Recording Scheme.

VETERINARY.

10/14. No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
4/25. No. 536. Inoculation of Cattle against Redwater and Gall Sickness, by Ll. E. W. Bevan, M.R.C.V.S.
12/25. No. 570. The Spaying of Bovines, by G. C. Hooper Sharpe, M.C., M.R.C.V.S., and M. H. Kingcombe, M.R.C.V.S.
6/26. No. 597. Suspected Poisoning of Stock: The Proper Procedure, by M. H. Kingcombe, M.R.C.V.S. (Lond.), and A. W. Facer, B.A. (Oxon.), A.I.C.
12/26. No. 618. Notes from the Veterinary Laboratory: Quarter Evil, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
1/28. No. 666. Notes from the Veterinary Laboratory: Praemonitus—Praemunitus, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
4/29. No. 739. The Laboratory Diagnosis of Animal Diseases: A Note to Emphasise some Points in the Preparation and Forwarding of Specimens, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer.
10/29. No. 756. Parasitic Gastritis of Cattle, by Ll. E. W. Bevan. M.R.C.V.S., Director of Veterinary Research.
11/29. No. 760. A Note on Sheep Diseases in Southern Rhodesia, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer, Department of Agriculture, Salisbury.
2/30. No 772. Notes from the Veterinary Laboratory: Ophthalmia, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
4/31. No. 819. Measles in Swine, by P. D. Huston, M.R.C.V.S.
10/32. No. 866. The Treatment of Intestinal Parasites of Sheep, by J. D. Coutts, D.V.S., M.R.C.V.S.
4/33. No. 886. A Preliminary Note on Contagious Granular Vaginitis in Southern Rhodesia, by D. A. Lawrence, B.V.Sc., Acting Director Veterinary Research.

5/34. No. 921. Myiasis (Screw-Worm) in Cattle in Southern Rhodesia, by D. A. Lawrence, Director of Veterinary Research, and A. Cuthbertson, Entomologist.

IRRIGATION, WATER SUPPLIES AND SOIL EROSION.

3/27. No. 633. The Cost of Pumping for Irrigation, by R. H. Roberts, B.Sc. (Eng.).
4/27. No. 640. Levelling for Irrigation, by Dr. W. S. H. Cleghorn, M.I.Mech.E.
11/27. No. 659. The Hydraulic Ram, revised by P. H. Haviland, B.Sc.
11/27. No. 660. Small Earthen Storage Reservoirs, by C. L. Robertson, B.Sc.
11/28. No. 668. The Water Act, 1927, by C. L. Robertson, B.Sc. (Eng.), A.M.I.C.E.
1/28. No 670. Irrigation Canals, by P. H. Haviland, B.Sc. (Eng.).
5/30. No. 782. Reinforced Concrete Water Tanks, by R. Hamilton Roberts, B.Sc. (Eng.).
6/30. No. 786. Low Concrete Dams, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
2/31. No. 808. The Application of Water in Irrigation, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
3/31. No. 811. Irrigation Canal Structures, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
8/32. No. 860. Soil Drainage and Utilisation of Vleis, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
2/33. No. 879. Conditions Governing the Hire of Government Boring Machines.
8/33. No. 900. Three Types of Water Tank, by R. H. Roberts, B.Sc. (Eng.), A.M.I.C.E., Assistant Irrigation Engineer.
6/34. No. 923. Soil Eroison, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).
6/35. No. 956. Annual Report of the Division of Irrigation for the year ended 31st December, 1934, by P. H. Haviland, B.Sc. (Eng.), Acting Chief Irrigation Engineer.
8/35. No. 963. The Dangers of Soil Erosion and Methods of Prevention.
9/35. No. 964. The Use of Ditchers for Constructing Contour Ridges, by C. Tapson, Devondale, Concession.
9/35. No. 967. How to use an Engineer's or Farm Level, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).
12/35. No 973. Domestic Water Supplies and Sanitation on the Farm, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).
3/36. No. 980. Results from Glenara Soil Conservation Experiment Station, 1934-35 Season, by C. L. Robertson, B.Sc. A.M.I.C.E., Chief Engineer, Irrigation Division, and A. D. Husband, F.I.C., Chief Chemist.

FORESTRY.

1/26. No. 575. Tending of Eucalyptus Plantations, by A. S. Thornewill, B.A.

11/29. No. 763. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.

1/30. No. 769. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.

4/30. No. 778. The Utilisation of Wood in Southern Rhodesia—Conversion and Disposal of Timber, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.

8/30. No. 791. The Utilisation of Wood in Southern Rhodesia: Fencing, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.

2/31. No. 809. Establishing Pines: Preliminary Observations on the Effects of Soil Inoculation. Issued by the Division of Forestry.

4/31. No. 817. The Raising of Forest Seedlings and Transplants on the Farm, by E. J. Kelly Edwards, M.A., Dip.For. (Oxon.), Acting Chief Forest Officer.

7/32. No. 857. Charcoal Burning on the Farm, by R. J. Allen, Forester, Rhodes Matopo School of Agriculture and Experiment Station.

11/32. No. 869. Wind-breaks and Shelter Belts, by A. A. Pardy, B.Sc., Forestry.

1/33. No. 874. Tree Planting, by the Division of Forestry.

4/33. No. 888. The Vegetable Ivory Palm (Hyphoene ventricosa), by G. M. McGregor, B.Sc., District Forest Officer, Matabeleland.

8/34. No. 927. Some Facts about Tung Oil, by R. H. Finlay, B.A., Dip. For. (Oxon.), District Forest Officer.

8/34. No. 928. Some Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants suitable for the Colony, by J. W. Barnes, Manager, Government Forest Nursery, Salisbury.

12/35. No. 974. Summary of the Annual Report of the Division of Forestry for the year 1934, by E. J. Kelly-Edwards, M.A., Dip. For. (Oxon.), Chief Forest Officer.

Price List of Forest-tree Transplants, Ornamental Trees Shrubs, Hedge Plants, Creepers and Seeds obtainable at the Government Forest Nursery, Salisbury.

HORTICULTURE.

4/27. No. 637. Harvesting, Packing and Marketing of Deciduous and Tropical Fruits, by G. W. Marshall, Horticulturist.

8/27. No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

2/29. No. 725. Investigations into "Collar-Rot" Disease of Citrus, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad)

3/31. No. 814. Avocado Growing in South Africa, by Redvers J. Blatt, B.Sc., Ph.D.
5/31. No 821. Vegetable Growing in Southern Rhodesia: Lettuce, by G. W. Marshall, Horticulturist.
6/31. No. 824. Vegetable Growing in Southern Rhodesia: Tomato Culture, by G. W. Marshall, Horticulturist.
9/31. No. 829. Asparagus Culture, by G. W. Marshall, Horticulturist.
11/31. No. 834. Celery Culture, by G. W. Marshall, Horticulturist.
1/32. No. 843. Vegetable Growing in Southern Rhodesia: Onion Culture, by G. W. Marshall, Horticulturist.
2/33. No. 876. Notes on African Aloes (Parts 1-6), by H. Basil Christian, "Ewanrigg," Arcturus.
10/33. No. 905. Notes on African Aloes (Parts 7-10), by H. Basil Christian, "Ewanrigg," Arcturus.
5/34. No. 920. Citrus Fruit Growing in Rhodesia, by G. W. Marshall, Horticulturist.
7/35. No. 960. The Rhodesian Home Orchard, by G. W Marshall, Horticulturist.

ENTOMOLOGY AND PLANT PATHOLOGY.

2/13. No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
6/15. No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
10/15. No. 219. More Household Insects, by R. Lowe Thompson, B.A.
2/21. No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.
12/24 No. 522 Notes on the Black Citrus Aphis, by C. B. Symes.
8/25. No. 548. Insect Pests of Cotton, by C. B. Symes.
4/27. No. 639. Diseased Plants for Examination: Collecting and Despatching the Material, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
9/27. No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
1/28. No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
2/28. No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
6/28. No. 696. Ticks Infesting Domestic Animals in Southern Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
11/28. No. 714. Trap Cropping against Maize Pests, by Rupert W. Jack, F.E.S., Chief Entomologist.
12/28. No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.S. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
3/29. No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
6/29 No. 742. What is Diplodia in Maize? An Answer to a Popular Question To-day, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
8/29. No. 747. Mycological Notes: (1) Seed Treatment for Maize against Diplodia; (2) Seed Treatment for Tobacco against Bacterial Diseases. Issued by authority of the Minister of Agriculture and Lands.

8/29. No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.

9/29. No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.

9/29. No. 754. "Pinking" of Maize: Report of a Preliminary Investigation, by T. K. Sansom, B.Sc., Plant Breeder.

6/30. No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.

6/30. No. 788. A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.

A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist. Supplement No. 1.

7/30. No. 790. Notes on the Control of Some of the More Important Insect Pests of Citrus in Southern Rhodesia, by W. J. Hall, Ph.D., B.Sc., Entomologist to the British South Africa Company in Southern Rhodesia.

10/30. No. 796. The Army Worm (Laphygma exempta, Wlk.), by Rupert W. Jack, Chief Entomologist.

11/30. No. 798. The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

1/31. No. 804. Locusts in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

8/31. No. 825. Some Common Diseases of Potatoes in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.

3/32. No. 848. Mycological Notes: Seasonal Notes on Tobacco Diseases: 3, Frog Eye; 4, White Mould; by J. C. F. Hopkins, B.Sc. (Lond.).

4/32. No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.

6/32. No. 856. A List of Plant Diseases occurring in Southern Rhodesia, Supplement 2, by J. C. F. Hopkins, B.Sc. (Lond.), Government Plant Pathologist.

9/32. No. 861. Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.

11/32. No. 868. Cultural Methods and Tobacco Whitefly in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.

5/33. No. 890. Locusts: Instructions for dealing with Flying Swarms, by the Division of Entomology.

5/33. No. 892. The Tsetse Fly Problem in Southern Rhodesia, by R. W. Jack, Chief Entomologist.

5/33. No. 893. Experiments with Tsetse Fly Traps against Glossina Morsitans in Southern Rhodesia, by R. W. Jack, Chief Entomologist.

6/33. No. 894. Mycological Notes. Seasonal Notes on Tobacco Diseases. 6. An Unusual Type of Frog Eye Spotting, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

6/33. No. 896. A List of Plant Diseases occuring in Southern Rhodesia. Supplement 3. (New Records for period June, 1932, to May, 1933.) Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

7/33. No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.

8/33. No. 899. The Black Maize Beetle (Heteronchus Licus Klug), by C. B. Symes.

10/33. No. 904. Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932-1933. Part I.: Control of Locusts, by R. W. Jack, Chief Entomologist. Part II.: Biological Notes on the Red Locust (Nomadacris septemfasciata, Serv.), by M. C. Mossop, A.F.C., M.Sc., Entomologist.

10/33. No. 906. The Locust Invasion of Southern Rhodesia, 1932-33, by R. W. Jack, Chief Entomologist.

2/34. No. 911. Screw Worm. A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Foreword by R. W. Jack, Chief Entomologist.

3/34. No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.

4/34. No. 915. Tsetse Fly and Game, by R. W. Jack, Chief Entomologist.

4/34. No. 917. The Life History of the Screw-worm Fly, by Alexander Cuthbertson, Entomologist.

10/34. No 934. Mycological Notes. Seasonal Notes on Tobacco Diseases. 7, Spraying in Seed-beds and Lands, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

12/34. No. 938. The Destruction and Control of Locust Hoppers, by R. W. Jack, Chief Entomologist.

1/35. No. 942. Mycological Notes. Seasonal Notes on Tobacco Diseases. 8, The Mosaic Mystery. 9, Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

4/35. No 950. The Control of Tsetse Fly in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

4/35. No. 951. Suspected "Streak" Disease of Maize. Notice to Growers, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

6/35. No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

8/35. No. 962. The Report of the Chief Entomologist for Year ending 31st December, 1934, by R. W. Jack, Chief Entomologist.

10/35. No. 969. The Objects and Value of Seed Treatment of Maize against Diplodia, by G. M. Wickens, Ph.D. (Lond.), D.I.C., Assistant Plant Pathologist.

5/36. No. 986. Annual Report of the Division of Entomology for year ending 31st December, 1135, by Rupert W. Jack, Chief Entomologist.

POULTRY.

1/29. No. 721. Poultry Keeping in Rhodesia: Pedigree Breeding, by H. G. Wheeldon, Assistant Poultry Expert.

4/29. No. 738. Hints to Breeders: Rearing Young Stock, by A. Little, Poultry Expert.

6/29. No. 740. Artificial Incubation, Breeding and Rearing of Chicks, by H. G. Wheeldon, Poultry Expert.
11/29. No 761. Housing and Feeding of Adult Stock, by H. G. Wheeldon, Poultry Expert.
10/30. No. 795. The Turkey, by G. H. Cooper, Assistant Poultry Officer.
1/31. No. 803. Geese, by G. H. Cooper, Assistant Poultry Officer.
9/31. No. 827. The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.
10/32. No. 865. Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Chief Poultry Officer.
11/32. No. 870. Trap Nests, by B. G. Gundry, A.I.MechE. (combined with No. 875).
12/32. No. 872. The Poultry Industry: Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.
1/33. No. 875. Another Trap Nest, by B. G. Gundry, A.I.Mech.E. (combined with No. 870).
3/33. No. 884. The Vitamins in Poultry Feeding, by G. H. Cooper, Poultry Officer, Matopo School of Agriculture and Experiment Station.
5/34. No. 918. The Moulting of Poultry: The Normal and Pullet Moult, by H. G. Wheeldon, Poultry Officer.
10/34. No. 933. Ducks on the Farm (Revised), by H G Wheeldon, Poultry Officer.
12/34. No. 939. The Use of Galvanised Iron in the Making of Some Appliances for Poultry Keeping, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
12/34. No. 940. A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
3/34. No. 947. Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
9/35. No. 966. Egg Marketing Bill: Draft of a Bill having for its purpose the more orderly Marketing of Eggs.
11/35. No. 971. Feeds for Poultry and How to Use Them, by G. H. Cooper, Assistant Poultry Officer.

The following pamphlets can be obtained from the Poultry Officer upon application:—

Selecting Birds for Laying Tests, by A. Little, Poultry Expert.
Tuberculosis, by A. Little, Poultry Expert.
Prevention of Disease among Poultry, by A. Little, Poultry Expert.
Preparing Birds for Show, by A. Little, Poultry Expert.
The Fowl Tick (Argas persicus), by A. Little, Poultry Expert.
Culling: A Seasonal Operation, by A. Little, Poultry Expert.
Choosing a Male Bird, by A. Little, Poultry Expert.
The Breeding Stock, by A. Little, Poultry Expert.
Diseases of the Digestive System, by A. Little, Poultry Expert.
Mating for Improvement and Increased Egg Production, by A. Little, Poultry Expert.
Partial Moult: Broodiness. Selection of Layers of Large Eggs, by A. Little, Poultry Expert.
Exhibiting Eggs at Shows, by A. Little, Poultry Expert.
Condition of Birds on Show, by A. Little, Poultry Expert.
Green Food: The Result of not Supplying Sufficient to Poultry, by A. Little, Poultry Expert.
Good and Bad Hatching Eggs, by A. Little, Poultry Expert.
Grading Fowls, by A. Little, Poultry Expert.

Housing: Three Important Essentials, by A. Little, Poultry Expert.
Advice to Prospective Poultry Farmers, by A. Little, Poultry Expert
Seasonal Hints—August, by A. Little, Poultry Expert.
Successful Chick Rearing, by H. G. Wheeldon, Assistant Poultry Expert.
Hints to Breeders, October, by A. Little, Poultry Expert.
Abnormalities in Eggs. by A. Little, Poultry Expert.
Hints to Breeders. Prepare for the Breeding Season, by A. Little.
Respiratory Diseases, by A. Little, Poultry Expert.
Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.
The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

12/22.	No.	436.	The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.
12/24.	No.	524.	The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.
2/25.	No.	532.	The Short Period Forecast and Daily Weather Report. by C. L. Robertson, B.Sc., A.M.I.C.E.
6/25.	No.	542.	Review of the Abnormal Rainfall Season, 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E.
10/28.	No.	712.	The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc. (Eng.).
10/31.	No.	832.	The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.
2/33.	No.	877.	Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.
3/35.	No.	948.	The Weather, contributed by The Meteorological Office.

AGRICULTURAL BUILDINGS.

9/25.	No.	554.	Pisé-de-Terre, by P. B. Aird.
4/26.	No.	588.	Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.
8/26.	No.	605.	Flue-curing Tobacco Barns. Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
5/27.	No.	644.	Tobacco Baling Boxes, by B. G. Gundry. Irrigation Branch.
11/27.	No.	661.	Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16ft., by B. G. Gundry.
10/32.	No.	863.	Piggeries, by B. G. Gundry, A.I.Mech.E.

CHEMISTRY.

MISCELLANEOUS.

9/28. No. 707. Wood-Charcoal in Southern Rhodesia, by T. L. Wilkinson, B.Sc., Assistant Forest Officer.

5/31. No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

6/31. No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

3/32. No. 849. The Preservation of Farm Beacons, by L. M. McBean, Acting Surveyor-General.
How to Make Use of the Fencing Law.
Twelve Simple Rules for the Avoidance of Malaria and Blackwater.
Summary of the Game Laws of Southern Rhodesia.

9/34. No. 931. Chacoal-Gas as Fuel for Farm Tractors, by W. F. Collins, Assoc.R.S.M., "Riverside," Marandellas.

11/34. No. 935. The Weeds and Poisonous Plants of Southern Rhodesia, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture. Part I.

5/35. No. 953. A Scraper for Levelling Land, by D. E. A. Gutsche, Field Husbandry Officer, Kakamas.

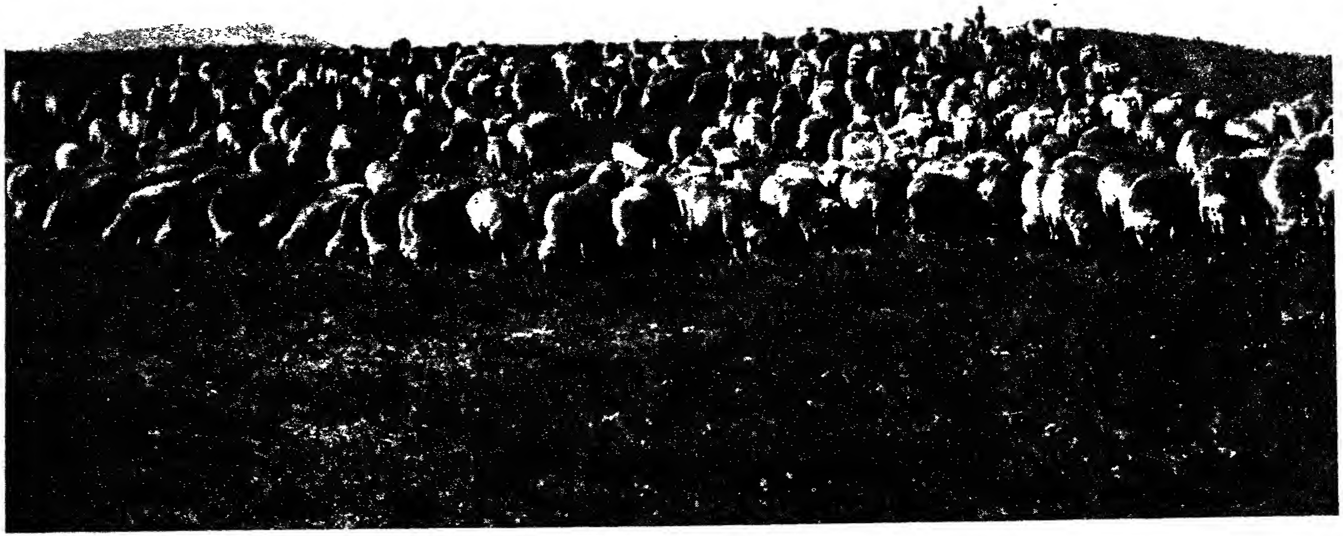
6/35. No. 958. A Cheap Levelling Device, by A. W. Laurie, Howick Vale, Concession.

8/35. No. 961. A Home-made Ridger. Contributed by Mr. Douglas Aylen, Somerset, Concession.

1/36. No. 975. Fertilizers, Farm Foods, Seeds and Pests Remedies Ordinance, 1914.

2/36. No. 979. The Prospects of Black Bass in the Inland Waters of Southern Rhodesia. Specially contributed.

6/36. No. 991. Silage and Silos.



Some of Mr. Hanmer's Merinos on the farm Fairview, Melsetter District.

THE RHODESIA
Agricultural Journal

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Salisbury Show.—This Show will be held on August 19th and 20th and will include a variety of classes for horses, pigs, sheep, maize, tobacco, farm produce, fruit, dogs, poultry and flowers. The opening ceremony will be performed by His Excellency the Governor of Northern Rhodesia, Sir Hubert Young, K.C.M.G., D.S.O., and a full programme of ring events has been arranged for both days. We wish the Society a very successful Show.

The Cotton Research and Industry Act (No. 38, 1936) was passed during the last session of the Legislature and promulgated on June 26th, 1936.

The Act establishes a Board to be known as the "Cotton Research and Industry Board" to supervise research work on cotton and on insect pests and diseases affecting cotton and other matters connected therewith, and to assist in the development of the cotton industry in the Colony.

The Board will consist of the following:—

Major G. S. Cameron, Chairman.—Representing and appointed by The British Cotton Growing Association, The Empire Cotton Growing Corporation.

Mr. E. R. Jacklin.—Representing the Department of Agriculture, appointed by the Minister of Agriculture and Lands.

Mr. V. S. B. Mercer.—Representing the Treasury, appointed by the Hon. the Minister of Finance.

Mr. Roger Thornton. — Representing the Cotton Growers, appointed by the Minister of Agriculture and Lands.

The Board will take over the Cotton Station at Gatooma, as well as the Ginneries at Bindura, Gatooma and Sinoia. The Board will receive annual grants from the Legislature and the staff of the Empire Cotton Growing Corporation will be at its disposal.

It is intended that the Board co-ordinate cotton research and the affairs of the cotton industry generally without, however, involving the Government in any measure savouring of control or monopoly of the industry. Native cotton growing will be fostered in co-operation with the Native Affairs Department and the Board will arrange for cash purchase of native produced cotton, or of any other cotton tendered to it. For the present the Bindura Ginnery will be operated only, and the Board will act as ginners and sellers for cotton growers and generally promote the interest of the industry.

Tobacco Research.—The Tobacco Research Board has considered an outline of the proposed future lines of investigation to be conducted at the Trelawney Tobacco Research Station. This is based upon lines discussed by all the technical officers

concerned and Dr. Nirenstein during his recent visit. The Board has agreed that all the major investigations shall consist of practical experiments framed so as to give results which will meet the commercial requirements of the industry as far as the quality and flavour of tobacco are concerned. It will be noted that the general programme which follows deals with the main sections under which the work at Trelawney is organised. The Board has recently arranged for the appointment for a full-time Plant Pathologist and Chemist so as to complete the staff required to carry out the programme proposed.

1. *Plant Breeding Programme.*

   (*a*) Continuation of the selection and improvement of as regards quality, flavour, etc., of existing varieties which have proved to be suitable for our conditions.

   (*b*) Hybridisation of promising varieties.

   (*c*) Genetical studies of special varieties.

   (*d*) New introductions. It is suggested that this should form only a strictly limited and rapidly diminishing part of the work of the Station as only very outstanding introductions should be continued for more than one season.

2. *Physiology.*

   (*a*) Nitrification of soils.

   (*b*) Vernalisation. To be checked by a complete nitrogen analysis.

   (*c*) Measurable characters as affected by environment.

3. *Crop Conditions and Field Trials.*

   (*a*) Spacing trials on different varieties to test improved quality and yields.

   (*b*) Rotation Trials. Subsequent effect of various crops to be tested in regard to the quality of the tobacco.

   (*c*) Topping and priming trials on different varieties.

   (*d*) Method and time of application of fertilisers.

   (*e*) Phosphate trials.

4. *Disease Control.*
   (*a*) Investigation of tobacco disease in general.
   (*b*) Nematode experiments on Roxburgh. Source of infection, water supplies, weeds, etc.

5. *Curing Investigations. Barn and Furnace Construction.*
   (*a*) Continuation of work and development of new lines of investigation as facilities become available.
   (*b*) Critical investigations of different varieties for texture, flavour and general curing quality.
   (*c*) Enzyme action, etc., during curing.

6. *Chemistry.*—A complete study of the chemistry of soils, fertilisers used and of the cured leaf which results from—
   (*a*) Special selections.
   (*b*) Various fertiliser treatments.

A chemical study of cured tobacco collected from different areas of the Colony as a control of commercial samples submitted to manufacturers for report on smoking quality and flavour.

The following circular from the Imperial Institute is published for the information of those farmers who are interested in tung oil. It is hoped shortly to publish further information concerning the harvesting and marketing of this crop.

"The Imperial Institute is aware that during the last few years you have been carrying out experimental trials in the cultivation of tung trees. It is anticipated that by this time your trees are probably producing fruits and that you may be harvesting a crop large enough for you to be desirous of offering the nuts for sale on the market.

In this connection the Imperial Institute foresees that you may experience some difficulty is disposing of your crop until such time as tung nuts have become a regular article of commerce. In order to overcome this difficulty, and to

assist growers to sell their produce, the Imperial Institute Sub-Committee on Tung Oil has made an arrangement with Tung Oil Estates Ltd., Tavistock House (North), Tavistock Square, London, W.C.1, whereby the company is prepared to pay the grower for quantities of tung nuts, of not less than one tons lots, c.i.f. United Kingdom port, the following prices per ton based on the London spot price of oil per ton at a date two months after leaving the port of shipment:—

London spot price of Tung Oil per ton.	Price payable for Tung Nuts of fair average quality per ton c.i.f. United Kingdom port.
£45 0 0	£9 0 0
55 0 0	11 0 0
65 0 0	13 0 0
75 0 0	15 0 0
95 0 0	19 0 0

When the price of tung oil varies between the above prices the nuts will be paid for *pro rata.*

The abovementioned prices will be applicable for twelve months from the date of issue of this letter, after which they will be reviewed from the experience obtained.

This offer is made for tung *nuts* and not for the fruits. The husks should therefore be removed from the fruits before shipment and only the nuts, complete with their thin woody shells, forwarded to the firm mentioned. The nuts should not be more than six months old.

If you should desire to avail yourself of this arrangement you are asked to communicate direct with Tung Oil Estates Ltd., who will furnish you with details as to shipment. When writing to the Company the species of tung grown should be stated, *i.e.*, either *Aleurites Fordii* or *Aleurites montana.*

In the event of your not having 1 ton of nuts for disposal it might be possible for you to co-operate with other growers in your district and to combine the produce from the respective estates with a view to the collection of a total quantity of at least 1 ton of nuts. *A. Fordii* nuts should not be mixed with those of *A. montana.*

My Committee desire to keep in touch with all developments in connection with the tung industry, and I shall therefore be glad if you will kindly inform me of any action you may decide to take in connection with the above offer."

Reward Wheat.—Elsewhere in this issue is a report on milling and baking qualities of Rhodesian Reward Wheat This is the first occasion that the two strains of this wheat have been grown in sufficient quantity for a commercial test to be undertaken. We are indebted to C. Russel Ridgeway, Esq., Managing Director of the Rhodesia Milling and Manufacturing Co., Ltd., for the report. It may be of general interest to recount a few particulars regarding the history of Reward Wheat in this Colony.

Reward Ottawa Wheat has now been grown in Southern Rhodesia during the past six seasons. It was originally brought from Canada by the Hon. L. Cripps and the seed was sown during the summer of 1929. Approximately 200 plants germinated, but the great majority were destroyed by rust. Two selections were made and these were the parents of the two strains which have been grown for the last five years.

The plant breeding work was transferred to the Government Farm, Marandellas, for one year, and naturally the conditions under which the wheats were grown on the damp vlei were most unfavourable; among the many varieties which were grown the two Reward strains were among those which showed the most promise. Since 1930 the plant breeding work has been conducted on the Government Experiment Station at Lower Hillside, Salisbury.

A fair amount of Reward seed has been bulked up on the Hillside Station and it has been used in variety trials with other well known wheats. Generally speaking up to now the two strains have yielded as well as other well known varieties on this Station, but it will be obvious that work of this nature will have to be conducted over a number of seasons to obtain reliable results.

Up to the present Reward has been very resistant to rust, and farmers to whom samples have been sent for trial have reported very favourably on it, both in regard to yield and rust resistance.

On an average Reward ripens at about the same time as do Quality and Kenya Governor, which means that it is one of the earlier maturing wheats.

Reward is a beardless wheat which has a fairly dense long narrow ear, white hairy chaff, red plump grain, a cross section of which presents a horny translucent appearance. It has strong straw, an erect growing habit and attains about the same height as Kenya Govenor when grown under similar conditions.

The Vacuum Magazine.—When touring South Africa by car the average motorist finds amongst his most absorbing wayside studies the many different wild birds to be seen in passing, a subject which is both captivatingly and instructively discussed in a well-illustrated article by Professor S. H. Skaife appearing in the new issue of the "Vacuum Magazine," published by the Vacuum Oil Company. Mr. Rene S. Caprara describes the exhilaration, depression and stimulation alternately assailing those concerned from the inside with South African broadcasting, and touches on some high lights in the remarkable development of wireless telephony and entertainment in this country. Broadcasting history is depicted in two pages of striking pictures.

Sugar growing and its progress in Natal are dealt with authoritatively, with pictorial comparison between the earliest and latest producing plants. Together with an excellent picture of R.M.S. "Queen Mary," fascinating details are given of the design, construction and equipment of Britain's shipbuilding masterpiece. There is a page of practical hints for assistance in various troubles afflicting motorists, who will find both interest and instruction in a non-technical explanation of the effects on carburetion of altitude and humidity. Prizes are offered for readers' successes in an entertaining new game.

A remarkably fine photograph of Montagu Pass forms the front cover illustration of the new issue, copies of which may be had (post free) on application to any of the Vacuum Company's offices.

***Principal Summer Crops.**—Estimated acreages, 1935-1936, compared with actual acreages, 1934-1935.

Crops.	Season 1935-36. Estimated Area Planted. Acres.	Season 1934-35. Actual Area Planted. Acres.
Tobacco, Virginia:—		
Flue-cured	38,445	37,650
Fire-cured	2,191	1,843
Other	45	14
Total...	40,681	39,507
Turkish	1,960	1,499
Total tobacco	42,641	41,006
Cotton	3,230	4,610
Maize	269,214	266,426
Ground nuts...	6,654	6,609
Potatoes	1,709	1,783
Green manure crops	63,784	48,112

From the foregoing figures it appears that the area planted to all crops, with the exception of cotton and potatoes, has increased. The season 1934-1935 was unfavourable to most crops, excessive rains being experienced at the beginning of the season, followed by a long dry spell. In 1935-1936 the position was reversed, rains being deficient during the period when planting usually takes place and excessive and prolonged during the ripening period. Although it was considered at first that as a result the yield per acre of most crops would be extremely low, it seems probable now that it will prove to be higher than in the previous season.

*From the Economic and Statistical Bulletin.

Summary of the Game Laws of Southern Rhodesia.

Owing to changes which have been effected in the Game Laws and in consequence of requests for information, the following is published in a summarised form.

Close seasons for game are:—

1. *Ordinary Game*—

   Mashonaland.—(*a*) Birds, from 1st October to 30th April; (*b*) antelope, from 1st November to 30th April.

   Matabeleland.—Birds and antelope from 1st November to 30th April.

2. *Special Game*—throughout the Colony—from 1st December to 30th June.

DEFINITIONS.

Ordinary Game.—Duiker, steinbuck, Sharpe's steinbuck (locally known as grysbok), oribi, klipspringer, warthog, francolin (including pheasant and partridge), sand grouse (Namaqua partridge), guinea-fowl, gnu or wildebeeste.

Special Game.—Buffalo, zebra, reedbuck, bushbuck, koodoo, sable, waterbuck, lechwe, pookoo, impala, tsessabe (in the native districts of Sebungwe, Lomagundi, Wankie, Insiza, Belingwe, Chibi and Gwanda only), Lichtenstein's hartebeest (in the native districts of Ndanga and Bikita only).

Royal Game.—Elephant, rhinoceros, hippopotamus, giraffe, eland, roan, gemsbuck, inyala, sitatunga, Lichtenstein's hartebeest (in all native districts except Ndanga and Bikita), tsessabe (in all native districts except Sebungwe, Lomagundi, Wankie, Belingwe, Insiza, Chibi and Gwanda), ostrich, rooi or Cape hartebeeste.

The following birds and animals are protected throughout the Colony:—

(1) All species of storks (*Plataledae Ciconiidae, Scopidae* and *Ephippiorhynchus* (Saddle billed stork).
(2) Nordmann's pratincole (*Glareola melanoptera*).
(3) All species of egrets (*Herodias*) and the cattle egret or tick bird (*Bubulcus ibis*).
(4) Wattled starling (*Dilophus carunculatus*).
(5) The dikkops (*Oedicnemus*) and all species of plover (*Charadriidae*).
(6) All species of cranes (*Gruidae*).
(7) All species of owls (*Strigidae* and *Bubonidae*).
(8) The Standard-winger nightjar (*Cosmetornis vexillarius*).
(9) All species of bee-eaters (*Meropidae*).
(10) All species of rollers (*Coraciidae*).
(11) The narina trogon (*Hapaloderma narina*).
(12) All species of flamingoes (*Phoenicopteridae*).
(13) All species of Ibis (*Ibididae*).
(14) All species of Orioles (*Oriolidae*).
(15) All species of sunbirds (*Nectarinia, Cynnyris, Anthothreptes*).
(16) All species of bustard (*Otidae*) commonly known as pau, pauw, koorhan, knorhaan.
(17) All species of lovebirds (*Agapornis*).
(18) All species of Hoopoes (*Upupidae* and *Irrisoridae*).
(19) Lemur (*Gelago crassicaudatus*).

The following are the fees for game licences:—

(*a*) Ordinary game licence	£1
(*b*) For a special game licence to a person domiciled in Southern Rhodesia	5
To a person not so domiciled	25
(*c*) For a royal game licence to a person domiciled in Southern Rhodesia	25
To a person not so domiciled	50
(*d*) For an owner's game licence	1
(*e*) For a sale licence	10

An owner's game licence entitles the holder to hunt any game animals (whether open season or close season and whether day or night) other than game protected by Proclamation. It does not entitle the holder to hunt any game birds except ostriches.

A sale licence entitles the holder to sell any dead game lawfully taken in the Colony during the open season.

With the exception of a royal game licence, licences are issued by Magistrates, Civil Commissioners and Native Commissioners.

The royal game licence is issued at the discretion of the Minister of Agriculture and Lands.

The shooting of game at night is prohibited, except where permission is granted by the Act.

The owner or occupier of cultivated land may shoot any wild animal or bird actually doing damage on such land.

Licences are not transferable and must be produced upon demand by any police officer.

The holder of a licence must not hunt game or trespass upon the land of another without permission of the owner or occupier.

Game may not be hunted in the Game Reserves of Wankie, Kazuma Pan, Victoria Falls and Matopos National Park areas. Other areas are gazetted from time to time.

No live game, rhinoceros horns, elephant or hippopotamus tusks may be exported from the Colony without the written permission of the Minister of Agriculture and Lands. Exporters of live game must also obtain a certificate of health from the Chief Veterinary Surgeon, Salisbury.

The issue of permits for the capture or hunting of game for scientific or other purposes is at the discretion of the Minister of Agriculture and Lands, to whom application should be addressed by the scientific institute or zoological society requiring the specimens.

The hunting of game is permitted in certain specified tsetse fly areas without licence.

An unlimited number of game of Class A may be hunted under an ordinary licence.

The holder of a special game licence may hunt three head of each of the species mentioned in Class B and no more, or should he elect to hunt more than three head of any one species in that class, then not more than fifteen head of game mentioned in Class B in all.

The number of head of royal game which may be hunted under a royal game licence is specified on each licence.

Heavy penalties are provided for contravention of the Act.

(Summarised from the "Game and Fish Preservation Act, 1929," and subsequent Proclamations.)

Stock Improvement Scheme.

The following conditions under which stockowners may obtain assistance from the funds provided for the importation and improvement of stock were recently published in the *Government Gazette*.

1. The object of the Stock Improvement Scheme is to provide means whereby approved stockowners in the Colony may obtain assistance to improve their herds or flocks.

The general condition and health and the methods of management applied to an applicant's herd or flock, especially in respect of the young stock, will generally be taken as the measure of efficiency of the stockowner for the purposes of this Scheme.

2. The present Scheme will be operative from 1st April, 1936, to 31st March, 1937, inclusive, and will be limited to the sum of £3,000 provided by Parliament for importation and improvement of stock under the votes of the Department.

3. All applications for assistance during the currency of the present Scheme should reach the Secretary, Department of Agriculture and Lands, P.O. Box 387, Salisbury, not later than the 22nd July, 1936.

Applications will be dealt with as far as possible in the order in which they are received.

4. Assistance will be limited to such stock-farmers as are, in the opinion of the Department of Agriculture, likely to make beneficial use of a good sire or pure-bred female stock in their herds.

The following conditions are, therefore, required to be complied with on the applicant's farm:—

(a) *Cattle.*—Sufficient supplementary feed must be available for the sire and weaners and young stock during the dry season, and sufficient camps must be provided, or other satisfactory arrangements made, to prevent heifers being bred until they reach breeding age.

(b) *Sheep.*—The flock must be dosed regularly as may be needed for internal parasites.

The ram must only be run with the ewes during the breeding season.

Sufficient supplementary feed must be available for the lambing season.

(c) *Pigs.*—Farrowing pens are required to be provided with concrete floors.

The bull, ram or boar selected must be approved by an officer of the Department of Agriculture and Lands and must be of a type considered suitable for the herd or flock of the applicant and for the conditions obtaining on the farm.

5. A. *Animals imported direct from the United Kingdom or other territories overseas.*

The Government will contribute to the cost of importing stock from overseas as follows:—

(1) Pedigree Bulls: A sum not exceeding half the certified landed cost of the bull on the owner's farm in Southern Rhodesia, provided that the total Government contribution in respect of any one animal shall not exceed £75, and provided, further, that this contribution shall not exceed the original certified cost of the bull. In arriving at the "landed cost" of the bull, buying expenses, such as travelling expenses and agents' commission, etc., shall not be included.

The export of any animals from the United Kingdom on which a Government contribution is made must be arranged through the office of the High Commissioner for Southern Rhodesia in London.

The importer will be required to:—

(*a*) submit a certificate from the breed society concerned showing that the bull is considered by the society to be good value for the money paid, or, failing such certificate, the animal will be valued on arrival by an official of the Department of Agriculture and Lands for the purpose of determining the maximum Government contribution payable in respect of the animal;

(*b*) insure the imported animal from date of purchase and for a period of one year after arrival in the Colony for a sufficient sum to cover the expenditure incurred, and to undertake to refund to the Government the contribution made towards the purchase price if the animal should die prior to arrival, or within one year of arrival, in the Colony.

(2) Pedigree rams and boars: A sum not exceeding half the landed cost of the animal on the owner's farm in Southern Rhodesia, provided that the total Government contribution in respect of any one animal shall not exceed £20, and provided, further, that this contribution shall not exceed the original certified cost of the animal. In arriving at the landed cost of the animal, "buying expenses," such as travelling expenses and agents' commission, etc., shall not be included.

The export of any animal from the United Kingdom on which a Government contribution is made must be arranged through the office of the High Commissioner for Southern Rhodesia in London.

The importer will be required to submit—

(*a*) a certificate from the breed society concerned that the animal is considered by the breed society to be good value for the money paid; or

(*b*) failing such certificate, the animal will be valued on arrival by an officer of the Department of Agriculture and Lands for the purpose of determining the maximum Government contribution payable in respect of the animal.

B. *Animals purchased in this Colony or imported from any territory in South Africa.*

The Government will contribute to the purchase of such animals as follows:—

(1) Bulls: A sum not exceeding half the certified cost of the bull, provided that the total Government contribution in respect of any one animal shall not exceed £15, except, that at the discretion of the Minister of Agriculture and Lands, this contribution may be increased to £25 in the case of stud bulls for use in established pedigree herds.

(2) Rams and boars: A sum not exceeding half the original certified cost of the ram or boar, provided that the total Government contribution in regard to any one animal shall not exceed £4.

6. Assistance to any one breeder or partnership will be limited to two bulls, two rams or one boar during the year, and under no circumstances will a contribution be made towards the cost of more animals than are deemed necessary by the Department for the requirements of the applicant's own herds or flocks.

Under special circumstances approved by the Minister of Agriculture and Lands, approved breeders may be assisted to effect the purchase of pure-bred female stock.

In such cases the contribution made by the Government shall not exceed half the amounts granted for the respective sires.

The other conditions in regard to the grants for female stock shall be similar to those for the respective sires.

In the event of a shortage of funds, if necessary, the number of bulls may be limited to one per applicant. The applications for grants in respect of male stock shall receive precedence over those for female stock.

7. No animal, except under special circumstances, to be approved by the Minister of Agriculture and Lands, shall be eligible for more than one grant during its lifetime.

8. Breeders who have bulls, rams or boars for sale, which are likely to be suitable for use in this Stock Improvement Scheme, are invited to send full particulars of each animal for sale to the Secretary, Department of Agriculture and Lands, P.O. Box 387, Salisbury, who will cause the animals to be inspected and the information in regard to them to be brought to the attention of applicants requiring such stock.

It is notified that—

(*a*) no grants will be paid on bulls which are eight years of age or older;

(*b*) no animal on which a grant is made may be sold or disposed of within a period of twelve months from the time when the grant is made, except that previous

consent in writing be obtained from the Secretary, Department of Agriculture and Lands. Failing such approval, the seller will be required to refund the amount of the grant to the Department, and the acceptance of a grant by an applicant will be taken to imply agreement to this condition;

(*c*) South African-bred bulls approved for a grant under the Scheme will be branded with the letter O on the off hind leg. Bulls, rams and boars may also be marked with a numbered ear tag for further identification;

(*d*) animals approved must be of service age and in good service condition;

(*e*) no grants will be made for the purchase of stock from outside this Colony unless it can be shown to the satisfaction of the Minister of Agriculture and Lands that suitable animals at a reasonable price are not obtainable in Southern Rhodesia.

Lining an Irrigation Furrow.

By R. H. Roberts, B.Sc., A.M.Inst.C.E., Assistant Irrigation Engineer.

Water flowing in an ordinary earth channel is subject to very heavy losses by leakage and absorption, especially if, as is often the case with storage schemes, the furrow is turned on intermittently for a few days at a time. In such cases, and particularly when the furrow traverses gravelly or sandy soil, the lost water may amount to a very considerable proportion of the total water available, and will cause a drastic reduction in the area of land which it will be possible to irrigate.

From both these points of view it will pay to line a furrow when the losses are heavy. The storage of water is expensive, and if a dam has cost £300 and the furrow is losing 50 per cent. of the water available, it is obviously worth spending £50 or £60 on a water-tight lining of the furrow. Even in the case of a diversion scheme the losses at the end of the dry season, when the normal flow is small, may lead to a serious reduction in the irrigable area, which can only be increased by lining some parts, or all, of the furrow.

The accompanying photographs illustrate a simple form of lining which has been developed by Capt. C. R. English, of "Lushington," South Marandellas. The lining consists of a brick floor, 18 inches wide, and the walls built of the flat stones which were readily available in the broken country through which this part of the furrow ran, as will be seen in the photographs. The bricks and stones were laid dry, and the joints pointed with cement mortar.

The materials used per 100 yards were as follows:—

1,800 bricks.
$2\frac{1}{2}$ pockets of cement.

Irrigation Furrow, Lushington Farm.

The actual cost will vary according to local conditions, but if bricks are taken at the usual average of 10s. per 1,000, and cement at 5s. per pocket, the cost of materials would amount to £1 10s. 6d. per 100 yards.

The cost of labour, in Captain English's case, worked out at £1 5s. 0d. per 100 yards, so that the total cost would be £2 15s. 6d. per 100 yards, or £49 per mile.

In connection with the labour, Captain English remarks, "No qualified builder was employed on this section. The actual bricks and stone were laid by a superior type of boy, my ex-head-boy, who has been responsible for most of the furrow-lining, paid 30s. per ticket, assisted by another paid 12s. 6d." It will be noted that the work has been extremely neatly done, and that the bed of the furrow is very even and level. Captain English continues, "The other labour consisted of two others employed in handing bricks and stone, filling in earth, etc., and three others bringing up stone with a sledge. A scotch cart was used intermittently to bring bricks." The bricks were carted an average distance of three-quarters of a mile, and stone an average distance of 600 yards.

The flat stones, which are a feature of the photographs, were only used for the portion of the furrow which ran through the hilly country. In the more open country bricks were used for the walls as well as for the bed of the furrow. The total length of lining built so far is 2,200 yards, and the whole is a very creditable piece of work.

The carrying capacity of a furrow of the size illustrated would be as follows:—

	Water depth 6 inches.	Water depth 12 inches.
Gradient 1 in 500	0.96 cusecs.	2.55 cusecs.
Gradient 1 in 1,000... ...	0.66 cusecs.	1.89 cusecs.

Reward Wheat.

REPORT ON THE BAKING PROPERTIES AND CHEMICAL ANALYSES.

By The Rhodesian Milling & Manufacturing Company, Ltd.

The wheat was grown on the British South Africa Company's Estate at Mazoe during the years 1935.

Preamble.—Chemical determinations were carried out in the laboratories of the Rhodesian Milling & Manufacturing Company, Ltd., Bulawayo, on the wheats which were then stored for about nine months, conditioned and milled. Chemical and baking tests were then made on the flours thus obtained.

Milling.—The only alteration from the commercial milling method was that the draught on the purifiers was increased, as the stocks were dressing too freely. The wheat requires a longer conditioning period than the usual mixtures do, but as this was not given, it was slightly under-conditioned when milled.

The wheat was milled at 14.70% moisture, the H_2O content of the product being:—

A.B.C. Flour (top 30%)	13.10%
Residual Flour (bottom 70%) ...	14.40%
Bran	15.20%

Chemical Analyses of the Wheat.

Reward Wheat BR.		*Reward Wheat B.*	
Moisture	9.20%	Moisture	9.20%
Maltose figure... ...	1.86%	Maltose figure... ...	1.86%
Nitrogen	2.77%	Nitrogen	2.83%
Protein	15.79%	Protein	16.13%
Lbs. per bushel ...	65.50	Lbs. per bushel ...	66.00

Chemical Analyses of the Flours.

A.B.C. Flour.—(Top 30%).

1.	Moisture	13.10%	Normal.
2	Ash...	0.35%	Indicates good separations.
3.	Maltose figure . .	2.87%	Very high for untreated flour
4.	Grade figure	5.00	Good.
5.	Colour figure... ...	7.20	Good.
6.	Nitrogen	2.22%	Very satisfactory.
7.	Protein...	12.65%	Very satisfactory.

Straight Run Flour—(100%).

1.	Moisture	12.60%	Low—probably dried out.
2	Ash	0.43%	Good.
3.	Maltose figure ...	2.59%	Very high for untreated flour
4.	Grade figure	9.00	Good.
5.	Colour figure... ...	7.50	Good.
6.	Nitrogen	2.52%	Good.
7.	Protein	14.36%	Good.

Residual Flour—(Bottom 70%).

1.	Moisture	13.70%	Normal.
2.	Ash	0.62%	Normal.
3	Maltose figure... ...	2.73%	Very high.
4.	Grade figure... ...	9.00	Good.
5.	Colour figure... ...	12.20	Very yellow. A characteristic of many Rhodesian wheats.
6.	Nitrogen	2.60	Excellent.
7.	Protein...	15.19	Excellent.

Test Baking.—All these flours baked exceedingly well. The doughs were elastic, glutinous and worked well generally, if anything, the residual flour was a little more distensible than the others. In all cases the final loaves were very pleasing, being of a nice shape and colour, and standing up well. The loaves were very large, and generally indicated a strong but nicely balanced flour.

Water absorption was:—

A.B.C. Flour	60%
Straight Run Flour	56%
Residual Flour...	58%

With regard to the interior of the loaves:—

A.B.C. Flour (top 30% of the flour run) gave a loaf with a nice even texture, the crumb colour being good.

Straight Run Flour (100% of the flour run) gave a loaf with a somewhat irregular texture, some of the pores being very large. The crumb colour was normal for a straight run flour of similar extraction.

Residual Flour (bottom 70% of flour run) gave a loaf with a fairly regular texture, with a rather dark crumb colour, and was shell topped.

OBSERVATIONS.

1. That in chemical composition Reward Wheat closely resembles Manitoba No. 1, but, although the protein is slightly higher, the general opinion formed was that the quality of the protein was not quite up to the No. 1 Manitoba standard.

2. In all cases the maltose figures were surprisingly high, but as the soluble extract of the one flour tested was 5.52% it is possible that germination was present in the incipient stages, and would account for high maltose figures.

The flours produced from the Reward Wheat were surprisingly good, and almost compared with similar grades of flour milled from Canadian wheat. It is a considered opinion that if this *wheat retains its present protein quantity and quality* it will be possible to substitute a considerable proportion of imported strong wheat used by Reward Wheat.

Boiler Feed Injectors.

(PENBERTHY TYPE).

FITTING, OPERATING AND CARE OF.

By Major C. E. GOAD, M.C., Boring Superintendent.

See that all pipes are cleared of scale and dirt, ends chamfered free from unturned cut-off tool burrs.

Joints.—When making pipe joints, red lead or graphite should be used. A leak in the water supply pipe prevents the injector working.

Stem of globe valve should be so packed that no air can get into the valve.

Check Valve. (Which is between the injector and boiler). —See that this is free from scale, that the valve or seat is not pitted. If badly pitted replace with new one, otherwise grind it in until perfect seating is obtained. There should be a globe valve on the suction side and another between injector and steam pipe from boiler. These should be fitted as near injector as possible. It is important that the valve between the boiler and injector does not leak when shut off, otherwise steam passing through injector when not in use will score the working parts of the injector and cause failure and also overheat the injector. Blow all dirt from steam pipe before fitting injector.

Do not use Stillson wrench when fitting injector, a lug is supplied with injector, place this in square hole in end of tail pipe or nipple then place wrench on lug.

Do not place injector too near boiler.

Do not have smaller pipes than injector.

Keep suction lift as short as possible.

Install strainer as dirt, such as straw, grass and hair, getting into injector will prevent its working.

A globe valve should be placed between check valve and boiler. This valve enables the injector to be dismantled even if check valve is leaking, also the check valve can be ground in without dismantling.

To Test for Leaks.—Plug end of water supply pipe, then fit piece of wood into overflow cap, so that when screwed down it will hold the valve in place, then turn on steam and it will locate leak. Do not fail to do this in case of any trouble.

Jets Liming.— Soak in one part of muriatic acid (spirits of salts) and seven parts of water as long and as often as necessary to keep parts free from lime. Do not scrape any part of injector.

Overflow valve may be ground in should it become coated with lime or pitted; to do this unscrew cap and with a screwdriver turn valve back and forth, which will grind in the seat. A little flour emery on the underside of the valve can be used.

To Clean.—Unscrew bottom plug and the delivery jet should drop out. If this, however, has been allowed to become heavily limed up, a little persuasion may be necessary. Do not use any sharp instruments, gently moving the end of jet to and fro will release it. Turn on steam at not less than 40 lbs. pressure and all dirt will be blown out. Examine all passages and drilled holes and see that no dirt or scale has lodged in them. Do not use anything that is likely to enlarge holes or passages, otherwise the injector will become unserviceable. Replace jet by setting in plug (which acts as a guide) and screw into place tightly. Be careful not to bruise any jets or body of injector, use no wrenches on body.

Operating.—To Start.—First open full the globe valve on suction pipe and then do the same with globe valve in steam line. If water issues from overflow throttle close the valve on suction pipe until discharge stops, regulate injector with water supply valve, not by steam.

See the valve between check valve and boiler is open.

If injector becomes overheated cool it down.

In Case of Trouble.—First be sure these instructions have been followed. Next consider the injector in a fundamental way as follows: the power comes through the steam pipe, its capacity comes through the suction pipe, and the suction pipe must bring in enough cool water to condense the steam, or else the combined steam and water cannot be passed through the small delivery jet. Too much water destroys the performance at low steam pressure. Too little or *too hot* water may give good results on low steam pressure, but fail to condense all of the steam at high pressure.

Overflow temperature will also indicate a shortage of either steam or water. With too much water or too little steam or if delivery jet and pipe system do not provide a free open passage to boiler, the water backs up and escapes through overflow. Injector is designed for steam and water, but has no room for condensed steam, water, dirt or air. Keep the injector cool and the overflow or exhaust open to atmosphere.

Note.—Delivery pipe must be full size of injector or larger and check valve tight to protect injector from overheating. Check valve should be placed as far away from injector as possible.

Overflow must be left open to atmosphere. a short piece of pipe may be used.

Veld Fires.

THE "FOREST AND HERBAGE PRESERVATION ACT, 1936."

By E. J. Kelly Edwards, M.A., Dip. For. (Oxon),
Chief Forest Officer.

It may be predicted with certainty that during the next few months the all too familiar veld fire will take its annual toll of valuable timber, grazing and wild life, and pave the way for more soil erosion.

It would be wise for all connected with the land to study the provisions of the new "Forest and Herbage Preservation Act, 1936," which was passed during the last session of Parliament, and which can be of the greatest assistance to those who wish to conserve the natural products of the lands.

Veld Burning.—The Act makes it an offence, punishable by severe penalties, for any person without authority to set fire to any vegetation which is not his property, or to kindle any fire which by spreading sets fire to any vegetation which is not his property.

If a person intends to burn growing or standing vegetation on land on which he is authorised to burn, he must give reasonable notice of his intention to all occupiers of adjoining land, at the same time stating as nearly as possible the proposed time of burning.

If a fire, burnt after notice has been given, does spread to adjoining land in spite of the exercise of proper care on the part of the burner, the latter is not liable for the offence of wilfully or negligently setting fire to or allowing a fire to spread to vegetation which is not his property, although he may be liable for damages if such a fire incurs loss on any person aggrieved.

Fireguards.—An owner or occupier of land (A) who wishes to protect it from fires, may call upon adjoining private land

holders (B) to contribute one-half of the labour or cost necessary to provide and maintain sufficient fireguards on the common boundaries. In the event of B's refusal or neglect to contribute, A may construct or maintain the necessary fireguards and is entitled to recover half the cost from B.

A sufficient fireguard must be not less than ten yards wide on either side of the common boundary.

A fireguard, provided it is of the required width, need not necessarily be a strip of cleared land, but may, for instance, consist of belts of fire resisting trees or other trees or plantations so treated as to prove adequate as firebreaks. If there is a dispute as to its sufficiency it shall be referred to the Minister of Agriculture and Lands, whose decision shall be final.

The Act enjoins that every person must properly extinguish any fire kindled by him on the land of another and on roadsides, outspans and vacant land. The practice of reasonable counter-firing is allowed when life, person or property are in danger from an approaching fire.

Trespass.—Entering upon the land of another, without his consent, in pursuit of or with the intention to pursue wild birds or wild animals, or to take honey or bees, or without right entering upon land enclosed by a fence, are offences subject to penalties of fine or imprisonment.

Cutting or Injuring Vegetation.—The Act makes it an offence to cut, remove or destroy trees and other vegetation belonging to another without lawful authority. It is also an offence knowingly to receive vegetation so cut or removed.

The Act allows the Minister to give protection against cutting or destruction to certain trees and plants which may be prescribed from time to time, *e.g.*, by reason of their scarcity or particular value.

The Act further allows the Minister to reserve whole areas in which the vegetation is to be protected or grazing forbidden, such as on stream banks or on hills, or at the headwaters of streams or other sites where soil and water conservation are important.

The reservation of such areas does not apply to private land on which there is a resident European occupier, unless at the request of the owner of private land.

Servant's Liability and Damages.—The Act provides that both or either servant and employer may be prosecuted for contravening any provision of the Act, if the servant is acting under the direction or command of the employer.

Nothing in the Act affects the right of a person to recover damages by civil action for any loss sustained by him.

Finally the Act makes provision that a plaintiff in any action for damages caused by fire from a locomotive may presume negligence on the part of the owner of the locomotive until rebutted by the defendant.

The detailed provisions of the Act read as follows:—

1. This Act may be cited for all purposes as the "Forest and Herbage Preservation Act, 1936."

2. The laws sets out in the Schedule to this Act are hereby repealed to the extent therein mentioned.

3. In this Act, unless inconsistent with the context—

"Minister" means the Minister of Agriculture and Lands;

"private land" means any land the ownership of which has by law, grant or title deed become vested in any person other than the Governor, and includes any land held by any person under any agreement whereby such person is entitled to obtain from the Governor title thereto on the fulfilment by him of the conditions prescribed by such agreement;

"vegetation" includes any tree and any part thereof, any bush, shrub, brushwood, undergrowth, grass and any other vegetation.

4. (1) No person shall wilfully or negligently set fire to any vegetation which is not his propery unless he has lawful authority so to do.

(2) No person shall wilfully or negligently kindle any fire which by spreading damages or destroys any vegetation which is not his property.

5. (1) Every person, before proceeding to burn growing or standing vegetation upon his own land or upon land on which he is permitted or authorised to burn such vegetation, shall give reasonable notice of his intention to do so to all occupiers of adjoining land. In such notice he shall state as nearly as possible the time at which such burning will take place.

(2) If a fire lawfully kindled after notice given in terms of the preceding sub-section spreads to adjoining land, the fact that such reasonable notice was given —

(*a*) shall to the person who kindled or was responsible for kindling such fire be a sufficient defence to any charge of contravening section *four* in respect thereof, unless it is proved that he wilfully or by the negligence of himself, his servants or agents caused or permitted such fire to spread across his boundaries to such adjoining land; but

(*b*) shall not affect the right of any person aggrieved to recover damages for any loss sustained by him as the result of such fire.

6. (1) Any owner or occupier of land who desires to guard against fires crossing the boundaries thereof may call upon the owner or occupier of any adjoining private land on the boundaries of which sufficient fireguards have not been provided and maintained to contribute one-half of the labour or cost necessary to provide and maintain sufficient fireguards on their common boundaries.

(2) If any person so called upon refuses or neglects to contribute as required by the preceding sub-section, the person so calling upon him may construct or maintain such fireguards and shall be entitled to recover from such first-mentioned person half the necessary cost of such construction or maintenance.

(3) For the purposes of this section a fireguard shall not be sufficient unless it is at least thirty feet wide on each side of the common boundary at all points thereof.

(4) If any fireguard is of the width required by the preceding sub-section, but its sufficiency for the purposes of this section is disputed on the ground that such fireguard is not entirely cleared of vegetation, the dispute shall be referred to the Minister for decision, and his decision thereon shall be final.

7. Any person who is upon the land of another, whether lawfully or not, or upon any road, outspan or vacant land shall carefully and properly extinguish any fire kindled or used by him, and until he has so done shall not go so far from any such fire as to be unable to control it by himself or his servants.

8. Nothing in this Act contained shall be deemed to prohibit any person, when his life, person or property is in danger of loss or injury from an approaching fire, from setting a light to and burning vegetation, in the manner commonly known as counter-firing, in order to prevent such loss or injury;

Provided that he shall take reasonable care that a fire so kindled does not spread beyond the limits necessary to secure him from such loss or injury.

9. No person shall—

(*a*) knowingly enter upon the land of another in pursuit of or with the intention of pursuing any kind of wild bird or wild animal; or

(*b*) take or remove honey or bees from the land of another;

without the consent of the owner, lessee or occupier of such land.

10. Except in the exercise of any right no person shall enter or be upon any land which is enclosed by a fence except with the consent of the owner or occupier thereof.

11. No person shall, without lawful authority so to do, maliciously cut down, fell, remove, injure or destroy any vegetation which is not his property:

Provided that the provisions of this section shall not apply to any native inhabitant of a native reserve in respect of vegetation growing in such native reserve.

12. (1) If he deems it necessary for the maintenance of water supplies, for the conservation of soil, for the protection of roads or other lines of communication, or generally in the public interest, the Minister may, notwithstanding the provisions of any other law, from time to time make regulations, not inconsistent with this Act—

(*a*) prescribing and altering for the whole or any part of the Colony a list of trees and plants which shall not be cut, felled, removed, injured or destroyed save with the special permission in writing of the Minister and on such terms and conditions as may be prescribed by the regulations; and

(*b*) defining and altering areas in the whole or any part of the Colony wherein it shall not be lawful to graze or depasture cattle or other domestic animals, or to cut, fell, remove, injure or destroy any vegetation whatsoever.

(2) The provisions of any regulations made under paragraph (*b*) of the preceding sub-section shall not apply to private land on which there is a resident European occupier, unless, at the request of the owner of such private land, the provisions have been applied to his land by the Minister by notice in the *Gazette*. For the purposes of this sub-section, "occupier" means the person who has for the time being the legal right of occupying such land.

13. (1) Any person who by act or omission contravenes any provision of this Act or of any regulation made and in force under this Act shall be guilty of an offence.

(2) Any person who receives any vegetation, knowing at the time of such receipt that it has been cut, felled or

removed in contravention of section *eleven* or of any regulation made and in force under this Act shall be guilty of an offence.

14. The penalties for offences against this Act shall be as follows:—

(*a*) For a contravention of section *four*, section *eleven*, or any regulation made and in force under section *twelve*, or for an offence in terms of subsection (2) of section *thirteen*, a fine not exceeding one hundred pounds, or, in default of payment, imprisonment for a period not exceeding one year, or corporal punishment in any number of lashes or cuts with a cane or rod not exceeding fifteen, or imprisonment for a period not exceeding one year without the option of a fine, or any two of the above-mentioned punishments;

(*b*) for any other offence, a fine not exceeding ten pounds, or, in default of payment, imprisonment for a period not exceedings three months.

15. If any servant when acting under the direction or command of his employer by any act or omission contravenes any of the provisions of this Act, such employer and such servant may both or either of them be prosecuted, and, if convicted, punished under this Act.

16. All magistrates' and native commissioners' courts shall have special jurisdiction in respect of person over whom they have jurisdiction by law to impose on summary trial the maximum punishments provided for in this Act.

17. (1) Nothing in this Act contained shall be deemed to affect the right of any person aggrieved to recover damages by civil action for any loss sustained by him.

(2) In any action for the recovery of damages sustained in consequence of a fire occasioned by a locomotive, it shall not be incumbent upon the plaintiff to prove that such fire was occasioned by negligence of the owner of such locomotive or any of his servants, but such negligence shall be presumed until such presumption has been rebutted by the defendant.

SCHEDULE.

Laws Repealed.

No. and Year of Law.	Subject or Short Title.	Extent to which Repealed.
Proclamation by the Governor of the Colony of Cape of Good Good Hope, dated 31st December, 1824.	The Boekhoo Plant	The whole.
Act No. 18 of 1859	Forest and Herbage Preservation Act 1859	So much as remains unrepealed.
Act No. 28 of 1888	Forests Act, 1888.	The whole.
Ordinance No. 9 of 1913	Herbage Preservation Ordinance, 1913	So much as remains unrepealed.
Act No. 6 of 1928	Herbage Preservation Ordinance, 1913, Amendment Act, 1928	The whole.

The Flue Curing of Virginia Bright Tobacco

IN SOUTHERN RHODESIA.

ADVANTAGE OF THE USE OF RECORDING INSTRUMENTS AND DIRECT READING HYGROMETERS IN BARNS.

By W. F. Collins, A.R.S.M., Sometime National Scholar in Biology, Injina, S. Marandellas.

PART I.

The production problems of the tobacco planter are two-fold. They differ from those of the producer of maize, the orchardist, the stock-breeder and the sheep-master in that his produce, before marketing, must undergo at the place of production at least one secondary treatment before grading, that of curing. Want of skill in this operation greatly diminishes the value of many crops. Much Government money is being and has been spent on tobacco-breeding and fertiliser trials. Little attention has been paid to the problems surrounding improvement in average quality by research into the numerous factors entailed in curing. The planter can secure no advice in this matter from the manufacturer or consumer. The guidance of official bulletins is uncertain and sometimes misleading. It is hoped that the following research, carried out on practical lines on a commercial scale by growers themselves may be of assistance to other producers.

It is not suggested that the practice elaborated is perfect or necessarily the best. It is known that results considered satisfactory by growers are secured by systems of treatment which are radically different. It is only by comparing such systems and by recording results that progress will be made.

The Riverside Estate plant referred to is one of the oldest and most important in Southern Rhodesia. It dates from the days of unimproved fertilisers when 300-400 lbs. of cured leaf to the acre was considered fair production. It has now reached a stage at which the production of a crop of 700-1,000 lbs. of a good average of heavy-bodied but bright leaf is considered normal. It knew the period during which nearly the whole output of Rhodesian leaf was marketed in the Union. Serious efforts have now been made to adapt the product to the larger and more difficult demands of the London cigarette and pipe-leaf trade.

All authorities on tobacco production stress the importance of securing highest possible quality in the leaf. "The question of quality is of primary importance and it will become increasingly so with the growth of intensive competition with other tobacco-producing countries."*

No apology therefore is needed for placing on record notes, made in the course of endeavours to improve the curing of tobacco on the Riverside Estate. These notes follow eighteen years' experience in growing and curing by the writer's brothers followed by four seasons' special study of the conditions.

Upon the question of curing depends a number of problems in connection with barn-design, furnace-construction, moisture-control, design of roofs, of inlet and outlet air-vents, all of great importance, in securing high curing efficiency.

An American authority remarks "probably in no other tobacco region in the world are so much experience and good judgment required in the curing of the crop as in the yellow-tobacco States." "Curing tobacco yellow is now regarded as an art which demands the closest attention, the best judgment and the most painstaking experience to attain the perfect results."†

An Australian authority writes, "Almost all growers have had the experience of bad curing when, according to general

*D. D. Brown. The Harvesting and Curing of Virginia Tobacco. *Rhod. Agric. Jour.*, March, 1933.

†Tobacco Leaf. Killebrew & Myrick. (Orange Judd Co.).

practice, their method has been faultless. Almost all growers state quite frankly that there is a great deal of luck in getting perfect results." Rhodesian growers agree that no two crops even on the same farm and off the same field can be safely cured out in exactly the same way. Each is naturally enthusiastic as to his results secured at some time under certain conditions but optimism is discounted each year by the appearance in the tobacco-grading sheds, of a number of poorly-cured crops. Were the conditions requisite for consistent results to be known to any one grower the production of outstanding quality by certain growers or special districts would tend to be repeated with consistent and increasing frequency, but this at present is by no means the case. Moreover, the aggregate success of a large proportion of the industry in its efforts to secure bright leaf, is deplorable.

From two seasons' crops of flue-cured tobacco dealt with by the Rhodesia Tobacco Board the following percentages appear:—

Crop.	Weight.	%age Brights.	%age Mediums.	%age Dark.	(%DP)
1929/1930 . . .	2,522,000	10%	44%	32%	(20%)
1931/1932 . . .	5,026,000	5.8%	46%	36%	(23%)

These figures do not take into account loose leaf and "outs," whose inclusion would render the picture even more unsatisfactory. On the other hand they do not represent the run of the whole crop.

The Rhodesian classification of "brights" does but scanty justice to the country's own tobacco, for the London market classifies a proportion of Rhodesion mediums as bright. Nevertheless it is obvious that the percentage of bright tobacco in Rhodesian crops at present is lamentably low.

On referring to graders at the warehouses it is found that some crops have a percentage of brights even lower than the above figures indicate. Many owe their low percentage of "brights" to what is known as "sponging." There is good reason to believe that this prevalence of "sponging" is in no small degree due to inadequate research into its causes and to imperfect technique in curing. Rhodesian sandveld resembles some of the best American bright-leaf soil

chemically and in its main constituent in being "nothing but a porous sponge of sandy material, destitute almost of every element that supports vegetable life." Presumably the American grower has greater skill in curing and produces a larger percentage of bright leaf.

Certain it is that the skill of many Rhodesian growers is such that they habitually secure a proportion of "DP" tobacco far below the 20-23% appearing in these statistics. Others therefore produce a much higher percentage of this unprofitable and discreditable leaf.

There is evidently an aggregate loss of many tens of thousands of pounds sterling to the industry each year on account of this deterioration of leaf which would have been cured a higher grade by more skilful practice.

FIELD CONDITIONS.

Importance of Fertiliser.—Previous experience at Riverside indicated that some of the best bright-leaf crops had been grown with a mixture of half superphosphate and half "Double Complete Tobacco" fertiliser yielding, at an application of 300 lbs. to the acre, theoretically:—

P_2O_5 58.51 lbs. N.10.5 lbs. K_2O 15 lbs. K/N ratio 1/1.5

For 1931/1932 the fertiliser used, under advice supported by analyses of the soils, was "Tobacco No. 4 Bloodmeal" yielding at the same application:—

P_2O_5 54.6 lbs. N.18 lbs. K_2O 24 lbs. K/N ratio 1/1.33

It was found that this mixture, supplied to White Stem Orinoco plants in two applications, produced a crop of good-looking leaf, yielding, under large-scale conditions, 750 lbs. of market tobacco to the acre, but the leaf, cured under both "rule of thumb" and under modified conditions, proved exceedingly difficult to treat. It gave an exceptionally high proportion of dull and sponged tobacco. This failure in curing is attributed largely to curing-factors discussed in this paper.

There was also, it is believed, an over-high proportion of nitrogen too slowly soluble in the second application to potash, 1 to 1.33 instead of the 1 to 1.5 previously and subsequently adopted.*

It was possibly also partly due to a high proportion of sulphate, present in large proportion in both the superphosphate and the sulphate of potash incorporated in the mixture.

For the 1932-1933 crop a more quickly soluble fertiliser yielding, under a 300 lb. application:
P_2O_5 66 lbs. N.24 lbs. K_2O 36 lbs. K/N ratio 1/1.5
was used on a considerable proportion of the crop.

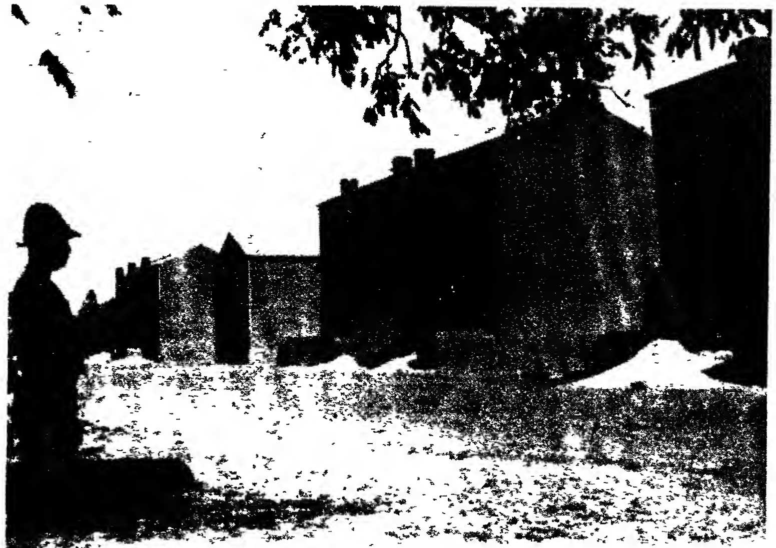
This mixture, under conditions both of excessive rainfall (normally producing "water ripe" tobacco, easy to cure) during the earlier part of the season and exceptional drought from the end of January onwards (normally producing tobacco difficult to cure), yielded a crop having a large proportion of bright leaf, easily cured during the earlier part of the season and producing no undue difficulties at the end.

Much of this crop was grown in red soil containing, say, 19% of iron and 70% sand (silica) as against the 90% sand and under 1% iron of sand-veld. As it is the experience of growers that higher percentage of iron in the soil tends to darken the tobacco, there was here a factor favouring a high percentage of darks and the curing out of the crop bright is the more remarkable.

CURING CONDITIONS.

Normal Rhodesian Practice.—It is thought that Southern Rhodesian practice, detailed in several official bulletins, by its insistence on excessive moisture in the barn during the yellowing of the leaf, by its favouring the pouring of water on the barn-floors, and by its advocacy of non-ventilation during the same stage, probably leads in some degree to the sponging trouble. Its suggestions also probably conduce to under-ventilation during the drying stage.

*The U.S. Department of Agriculture recommends 4% of Ammonia (say, 3.29 N.) to 6% Potash, a ratio of 1/1.83. (Farmer's Bulletin No. 571. "Tobacco Culture.")



Curing barns on Riverside Estate.

"As soon as the barn has been filled (with leaf), the door and ventilators are closed to prevent the escape of moisture."

"During this time (the yellowing period) the atmosphere of the barn *should be kept saturated* to prevent the leaf from drying out."

"When the barn is becoming too dry it will be necessary to introduce more moisture into the barn *by pouring water on the floor* and lower walls."

"During excessively wet spells, and when the leaf is heavy-bodied and contains a good deal of moisture, it may sometimes be advisable to open slightly the top ventilators, *when the temperature in the barn reaches* 105 *deg. to* 110 *deg. F.* (during the drying period) and thus reduce the amount of "sponging" which often takes place when the barn is kept closed, *until a temperature of* 115 *deg. the temperature to be reached before ventilation is recommended under normal conditions*, is registered within the barn."*

This advice as to humidity, recommending saturation of the internal atmosphere of the barn during the yellowing period, runs counter to American advice backed by far longer experience in tobacco culture—"the relative humidity should be about 85%" remarks the American official publication.†

Rhodesian advice on ventilation also run counter to official American practice:—"The warm moist air in the barn must be constantly replaced by the less humid outside air" (Farm. Bull 523, p. 14.).

Both authorities agree that too little importance is attached by growers to the matter of the humidiy within the barn, but for measuring this humidity both advocate the use of the wet-bulb hygrometer, an instrument not easy to read and requiring a calculation or reference to a table for every reading.

In view of this conflict of opinions of official authorities it is not surprising to find that uncertainty is admitted and that the Rhodesian planter is advised that he "should use

*Tobacco Culture in S. Rhodesia, by D. D. Brown. *The Rhod. Agric. Jour.*, pp. 233, 234, March, 1933. Minist. Mines & Agric., S. Rhod.

his standard methods and formulae which personal experience has proved to yield the most satisfactory results in curing the crop."†

Such "standard methods" vary between limits such that some growers close all bottom ventilators throughout curing. Others add no moisture during curing. Barn conditions may be such that both lines of procedure may occasionally produce good curing but, in presence of external variations due to cold, wind, rain and normal daily changes, such procedure obviously must produce, over a series of seasons, results which are lamentably inefficient and even disastrous.

The results of work at the Riverside barns, based largely on the research of the State Electricity Commission of Victoria, Australia, and the use of a new type of hygrometer and thermometer, both keeping automatic and permanent records, indicate that it is of the utmost importance that all leaf shall be living, undamaged by wilting, overheating or handling, when placed in the barn, that the officially recommended practice of keeping the barn entirely closed during the yellowing stage of curing is altogether erroneous, that saturation of the atmosphere throughout the yellowing period is often difficult, indeed sometimes almost impossible to maintain, that efforts to maintain it, especially towards the end of the yellowing period are extremely dangerous, also that the closing of the barn during yellowing, in efforts to retain saturation, leads to stifling and dullness of the leaf.

Research by the State Electricity Commission of Victoria has resulted* in a very important discovery that there is a third factor, hitherto unnoticed by tobacco research, materially influencing the sponging of tobacco—the carbon dioxide content of the air during the yellowing stage.

In Australia by tests in a barn which was made air-tight it was found that the closed barn condition "resulted in a greatly reduced rate of colouring and an almost complete absence of bright leaf." It was found also that "in the

†Common Faults in Curing Virginia Bright Tobacco. p. 7, Min. of Agric. and Lands.

*Report of State Electricity Commission of Victoria, July 1932. *Rhod. Agric. Jour.*, Jan., 1933.

chemical characteristics of the kiln atmosphere rather than in its temperature or moisture content the controlling factor was to be found." This report continues with the very important remark:—

"It should be remembered that curing is a maturing process in a still living leaf, involving a succession of physiological processes which require the inspiration of oxygen and the expiration of carbon dioxide and other gases. In an enclosed space the expired gases must accumlate." Therefore if all ventilators be closed the leaf cells will die by suffocation before complete yellowing. Only in very leaky barns will there be a large proportion of bright leaf, under present Rhodesian practice.

In the air-tight barns of the Electricity Commission an accumulation of up to 7% of CO_2 was found. Leaf breathed best at a concentration of 1.9% of CO_2 and with air passing into the barn at the rate of 138 cu. ft. per ton of leaf per hour. Under Rhodesian closed-barn conditions the CO_2 content of the air must necessarily be high, especially if the flues be leaky, as is often the case, admitting a proportion of the flue gases.

This requirement, amounting to the air contained in a 5-6 ft. cube, per ton per hour, would not seem excessive but, under close packing in the barn, a condition not infrequent in Rhodesia, it would appear difficult to ensure that all leaves shall secure a sufficient supply of air. An excess therefore appears desirable.

Secondary in importance to supply of sufficient pure air for healthy breathing appears to be the furnishing of adequate moisture and of security against chill of the leaf.

The Victoria Electricity Commission confirms American practice in stating that "much lower percentages of humidity, particularly at low temperatures, are equally effective in developing colour in a ripe leaf." "All that is necessary is to provide such environmental conditions that the sap cells will not collapse, and this is secured by enveloping the leaf in an atmsophere upwards of 75% saturated according to tem-

perature." A completely saturated atmosphere at high temperatures is dangerous, for precipitation must result if the temperature should fall only one degree, causing condensation on the leaf, one of the conditions most to be avoided.

The Commission is of opinion that "The practice that appears to give the best results is to commence curing in a well-saturated atmosphere, allowing the humidity to diminish slightly toward the end of the colouring process."

The question now presented itself as to how these observations could best be adapted to Rhodesian conditions.

(To be continued.)

Cotton Marketing.

By Th. G. Hesse.

To the farmer the mechanism of marketing his crops must always be of interest, and as far as cotton is concerned the machinery involved in moving a world production of about 25 million bales smoothly and economically from the field to the spinning mill provides a study of absorbing interest.

Many growers are, no doubt, conversant with the factors involved, yet a brief review may prove of interest to newcomers to the industry. Also to others, particularly as native cotton growing establishes itself, necessitating buying of seed cotton, for cash, out in the Reserves.

Is there any connection with the 1d. per pound paid the native and the mysterious quotations in the daily paper of May 6.21d., July 6.07d., January 5.65d. for cotton in Liverpool? Indeed, there is a connection, a very close one, although the 1d. is paid for a pound of seed cotton out in "darkest Africa" and the 6.07d. is paid for July Futures on the Liverpool Cotton Exchange. In due course that sensitive barometer of world cotton prices—the Cotton Exchange—will react to the purchases from the natives, though the reaction may be infinitessimal.

It is intended to trace and explain the connection just mentioned in its broad outline without going into technicality more than is necessary.

FUTURES MARKETS.

The commercial value of cotton in any part of the world at any given time is governed by the world market price as expressed by quotations on the various "Cotton Futures" markets. Such markets exist in Great Britain at Liverpool, in the United States at New York, New Orleans and Chicago and on the Continent at Bremen, Germany, and at Le Havre, France. All these markets deal in contracts for "American" cotton. Egyptian cotton "Futures" are dealt with exclusively at Alexandria and East Indian cotton "Futures" at Bombay, while Liverpool, apart from the "American," also has special markets for Egyptian and East Indian "Futures."

All African grown cotton (excepting Egyptian) compares with "American" cotton, and hence we are only interested in the quotations and dealings of those markets dealing with "American Futures." Of these, the Liverpool market is for us the ruling one, and in this review the Liverpool "American" Futures market is dealt with specifically.

The function of these "Futures" markets is to provide trading centres where cotton Futures contracts may be readily dealt in. They have developed in the course of time out of the requirements and needs of the Cotton Trade into the large, important and wonderfully organised markets of our day.

THE FUTURES CONTRACT.

The Liverpool Cotton Exchange is open daily from 10 a.m. to 4 p.m. for continuous trading in Futures. Dealings are in contracts for delivery of 48,000 pounds nett, *i.e.*, 100 bales of American cotton *ex* Liverpool Warehouse during a stated month, and contracts may be dealt in for delivery two years ahead. The price is quoted for delivery of "Middling, fair colour, fair staple." Any other quality may be tendered but nothing below the grade of Low Middling, any difference in value from the basis of "Middling" being adjusted at time of delivery, by arbitration.

It will be seen that all material factors are definitely fixed, *i.e.*, place and time of delivery, quantity and quality. These contracts may therefore be freely dealt in, the only factor remaining to be agreed upon being that of price.

Although Futures may be dealt in for any month up to twenty-four months ahead, in actual practice transactions are generally concentrated on so-called trading months which are January, March, May, July and October—while the other months are much neglected and rarely traded in. In the local Press we therefore see cotton quoted in the following terms:—

> On the Liverpool Cotton Exchange, American Futures, Basis Middling, Low Middling clause, were: May 6.21d., July 6.07d., October 5.75d., January 5.65d., Spot Middling 6.56d. The Futures market is steady.

Dealings in Futures are restricted to members of the Liverpool Cotton Association, Limited, who act as brokers for non-members. The members are responsible to each other for contracts made, without need to disclose who the principals are on whose behalf they are dealing. Once a week each member must adjust the difference in value on open contracts brought about by the rise or fall in the market since last "settling day," by paying in or receiving differences through the Clearing House. Every Monday at 11 a.m. the prevailing price is fixed and forms the basis for calculation of these differences.

Futures may be dealt in only on the floor of the Cotton Exchange. The scene is a fascinating, and very often an extremely animated one. The dealers are gathered around the "Ring" calling out their bids—and in the tumult that often arises well understood ring terms and signals are used. At busy times hundreds of contracts may be concluded in the course of few minutes amid the bedlam of shouting and gesticulating dealers, bewildering to the uninitiated onlooker. Every transaction that involves a change in the price is immediately posted on a huge blackboard forming the background of the trading ring. As each transaction goes on to the board it simultaneously goes over the "Ticker" machine and is thus flashed instantaneously to all parts, as well as to the other Futures Markets. In our local paper the "Closing" quotation only is given. After close of the market a "Daily Report" is issued showing the day's transactions. A reprint of the section in the report dealing with "American" Futures on April 20th, 1936, is given on a separate page.

In addition the report shows the transactions in the other sections of the market; gives the day's quotations received by cable from New York, New Orleans, Alexandria, Bombay, Havre and Bremen. Then follow official spot quotations, Foreign Exchange Rates, Weather Reports from the U.S.A. and statistical data showing the day to day movement of cotton in all parts of the world; official crop reports, etc. Altogether a very comprehensive document of all vital factors affecting the Cotton Market.

A purchase of a given position, say, "July delivery," may be liquidated forthwith by a sale of the same position. That is to say, it is not necessary to wait until July to receive delivery of the cotton from one party against the purchased contract, and then to deliver it on to another party in fulfillment of the sale contract. The two contracts cancel each other and may therefore be liquidated forthwith, the difference only being paid. The payments are effected through a Clearing House. With all intermediate contracts thus eliminated the ultimate position when July comes along will be that the party wishing to deliver cotton will do so direct to another party wishing to receive the cotton.

This feature of being able to buy or sell contracts at any time, then to liquidate them and to pay over differences only may, at first glance, appear to stamp the "Futures" market as a purely speculative market inasmuch as the actual cotton may not enter into the picture at all. While the market is used to some extent for purely speculative buying and selling, this is not its real function or use which, on the contrary, is to provide those engaged in the Trade with facilities to insure their legitimate dealings in cotton against price fluctuations.

HEDGING.

The world's cotton output of some 25 million bales is offered by the producer for immediate sale as soon as harvested, but the user of the cotton, the spinner, only requires it in deliveries spread over the twelve months of the year. The cotton merchant provides the bridge. He it is who buys the cotton from the producer in all parts of the world, carries it to the spinning centres, sorts it and stores it until wanted by the spinner and then delivers it at his door. He it is also who looks after the "carry over" from one season into the next. To do this efficiently and at low cost he must be able to cover himself again the risk of market fluctuations on the stocks held, otherwise his business would be purely speculative and he would have to charge an inordinate price for his service to cover the risk. This insurance or cover is provided by the Futures Market in the following way.

LIVERPOOL COTTON ASSOCIATION DAILY REPORT.

LIVERPOOL FUTURE DELIVERIES (in Pence per lb.) **MONDAY**, 20TH APRIL, 1936.

Deliveries.—American, BASED ON UNIVERSAL STANDARDS, BASIS MIDDLING, LOW MIDDLING CLAUSE.

American Futures Market opened quiet, steady, 1 point decline to 1 point advance, and closed at 1 point to 3 points decline.

	S'day's Close.	To-day's Opening.	Business before 12-15.	Settlement	Prices 11-0.	Value 12-15.	Business after 12-15.	Highest and Lowest Transactions		Value Close.	
April	6·31	6·30	..6·30	April	6·32	6·30	..	6·30	6·30	6·29	April
May	6·20	6·20–21	..6·20* 1 20 19 20 19 18* 19*	May	6·21	6·19	..6·19 18 17 18 17* 18 17	6·21	6·17	6·18	May
June	6·11	—	..	June	6·11	6·09	..	—	—	6·08	June
July	6·03	6·03–04	..6·04 3 4* 3 4 3* 2* 3* 02 6·01 2* 01	July	6·03	6·01	..6·01 2 01 6·0 5·99 6·0* 5·99 6·0* 5·99 6·0 5·99* 6·0 01 6·0	6·04	5·99	6·00	July
August	5·91	—	..	August	5·91	5·88	..	—	—	5·88	August
September .	5·80	—	..	September .	5·81	5·78	..	—	—	5·78	September
October ...	5·72	5·72	..5·72 1* 2 1* 2 1* 2 1* 72* 5·71 70 69* 70*	October ...	5·72	5·70	..5·70 69 8 69 70* 69 70 69 68 70*	5·72	5·68	5·70	October
November..	5·66	—	..	November..	5·66	5·65	..	—	—	5·65	November
December .	5·65	—	..	December .	5·65	5·64	..5·63* 64*	5·64	5·63	5·64	December
January ..	5·65	5·65	..5·65 4* 5* 4* 63	January ..	5·65	5·64	..5·63 2 3* 2* 4 3 2* 64	5·65	5·62	5·64	January
February ..	5·65	—	..	February ..	5·65	5·64	..	—	—	5·64	February
March	5·65	—	..5·63* 64	March	5·65	5·64	..5·62* 4* 3 64*	5·64	5·62	5·64	March
April	5·65	—	..	April	5·65	5·64	..	—	—	5·64	April
May	5·65	—	..	May	5·65	5·64	..	—	—	5·64	May
June	5·64	—	..	June	5·64	5·63	..	—	—	5·63	June
July	5·63	—	..	July	5·63	5·62	..	—	—	5·62	July
August	5·59	—	..	August	5·59	5·58	..	—	—	5·57	August
September .	5·55	—	..	September .	5·55	5·54	..	—	—	5·52	September
October ...	5·51	—	..	October ...	5·51	5·50	..5·48*	5·48	5·48	5·48	October
January ...	5·46	—	..	January ..	5·47	5·46	..5·46 44	5·46	5·44	5·44	January
March	5·46	—	..	March ...	5·47	5·46	..	—	—	5·44	March
	Very steady					Quiet				Quiet, steady	

As the merchant *buys* cotton from the producer he simultaneously *sells* equivalent amounts of Futures Contracts. The cotton is shipped to him—if from Rhodesia it will be a month or more before it is taken into his warehouse at Liverpool. In due course he *sells* the cotton to a spinner and simultaneously *buys* equivalent amounts of Futures contracts. The Futures contracts are then liquidated and the differences only paid over. If in the intervening period the market has risen he has lost on his "Futures" which he had to buy back at a higher price, but as he will have sold the actual cotton to the spinner at the higher price his loss is made good, and he breaks even. In the same way he will break even if the market has dropped during the intervening period. He will buy back his Futures at a lower price and show a profit, but as he will have sold to the spinner at the lower price, he has made an equivalent loss on the actual cotton. This process of covering in the "Futures" market is called "Hedging."

In a very similar way a transaction with a spinner to deliver cotton in, say, six months' time would be "hedged" by the merchant, and there are innumerable other transactions by the merchant, the producer, and the spinner that call for "hedging" in order to insure against price fluctuations. In actual fact and practice we have the position that virtually every purchase and every sale of cotton is hedged and in this way leads to a transaction in one or the other the Futures markets, which thereby become the final market where supply and demand meet. This makes the Futures market the finely attuned barometer of the world market price of cotton. With quotations flashed instantly to the four corners of the world, a buyer in Peru will be buying on the same basis as his confrere in, say, Rhodesia or the United States or in China.

SPOT TRANSACTIONS.

In the example given on a previous page of the Liverpool quotations published in the local Press appeared also "Spot Middling 6.56d." This quotation relates to American cotton, Middling, fair colour, fair staple, *ex* Warehouse, Liverpool—that is to say, "on the spot" and available for immediate delivery. It will be noticed that this quotation stands at a substantial premium above the " Futures " quotation for the

current month (*i.e.*, May in the example quoted). This seems anomalous, seeing that the "Futures" quotation is also based on "Middling." However, we must remember that the seller of "Futures" has the option of delivering any other quality of cotton, though making good the differences in value as against middling—and this explains the premium of the "spot" quotation. A spinner wishing to receive "middling" cannot risk receiving inferior cotton, as the price compensation does not help him if it is middling cotton he requires. He is, therefore, prepared to pay a premium—in the example quoted 0.35d. (*i.e.*, spot middling 6.56d., May Futures 6.21d.= premium 35 points)—and be certain that middling will be delivered. The premium varies according to supply and demand. The highness of the premium indicates that middling cotton is relatively scarce—in years of plentiful supply of good grade cotton the premium will drop to, say, 10 points or vanish altogether.

The narrow meaning of the term "Spot Cotton" is then that the cotton is on the "spot," *i.e.*, in warehouse at Liverpool. But the Trade gives it a wider meaning and refers to all transactions in actual cotton, even if for "forward" delivery or "afloat" as "spot" transactions in distinction to a "Futures" transaction.

BASIS.

The foregoing will have brought out the inter-relation of "Futures" and "Spot" dealings. And logically this must be so, for as virtually every deal in cotton is hedged by an opposite deal in Futures this must have a close relation of values as a consequence. Hence the value of any style of cotton is always thought of and expressed in relation to "Futures" quotations.

Good grade, or good staple cotton, will be worth more than the "Futures" quotation (*i.e.*, stand at a "premium") while low grade or short staple cotton will be worth less (stand at a "discount").

These differences are referred to by the Trade as the "Basis," and a premium is expressed as points "on," while a discount as points "off." So far reference has been made to the "Spot Middling" quotation only, but in actual fact all

grades are quoted (not only Middling) daily at 12.15 p.m. by a special committee of the Liverpool Cotton Association, and appear in the "Daily Report" in the following form:—

Monday, 20th April, 1936.

OFFICIAL SPOT QUOTATIONS (in pence per lb.).

American... ...	G.O.	S.G.O.	L.M.	S.L.M.	Mid.	S.M.	G.M.	S.G.M.	M.F
"Fair Staple"	5.66	5.95	6.15	6.40	6.60	6.80	7.00	7.30	7.70
i.e.	65off	35off	15off	10on	30on	50on	70on	100on	140on

By reference to the record, given on a previous page, of the day's transactions in the Futures Market, it will be seen that the 12.15 p.m. values are specially shown. On April 20th, 1936, the value of "April" Futures (the current month) stood at 6.30d. Middling being 30 on made its value 6.60d.

The function of these quotations really is to fix the value between grades for use is valueing cotton delivered against Futures contracts. Apart from this they are binding on no one. Furthermore, they only give differences of grades but do not take into account staple differences.

The above amplification on the subject of Official Spot quotations has been given mainly with the object of showing how the value of any given style of cotton is brought into relation with the ruling quotation of Futures by being quoted "on" or "off." As a further example:—In Lancashire the spinner generally comes to Liverpool to personally go over a selection of parcels his buying broker has called for from merchants. Having made his selection and asking what the price wanted is, he will merely be told: 60 "on." If he accepts, the price of Futures at time of acceptance is taken, let us say it is ... ... 6.30d. then

Basis	0.60d.	"on"
Invoice price	6.90d.	

The "basis" fluctuates from time to time in accordance with supply and demand. As already said, in years in which climatic conditions have been favourable for the production

of a good quality crop, the basis for good and high grades will be low with a narrow margin for the lower grades, while the reverse position would rule in an unfavourable year. Such fluctuation in basis may be further accentuated by the conditions of the textile trade, depending on the demand for different styles of cotton.

While fluctuations in the Futures markets are continuous and very often sharp and considerable, fluctuations in "basis" are generally gradual and moderate.

As the cotton merchant is able to insure himself against fluctuations in the market by "hedging" and, as was explained, does in fact so cover himself, the merchant does not count on market fluctuations to make his profit. He reckons to get his profit out of the "basis," that is, he will endeavour to buy his cotton at the lowest possible "basis" and sell it to a spinner at the highest possible "basis." This explains the feature, to many rather strange and inexplicable, why cotton can always be sold irrespective of whether the market be high or low. The bargaining takes place in respect of the "basis," it being quite immaterial to the merchant whether the basic Futures quotation be 5d. or 10d., the market a rising or falling one, for he will cut out the risk of those fluctuations by hedging. Indeed, *as trade is always stimulated by a rising market and high prices the merchant would rather have such conditions than low prices or a falling market, usually an indication of stagnant or bad trade.*

LOCAL MARKET.

We have so far dealt mainly with conditions in Liverpool and may now turn to consider the factors determining the price of cotton in this country. Fundamentally the factors remain the same, only we now have to allow for the cost of taking the cotton to Liverpool.

The cotton merchant in Liverpool usually buys his cotton from overseas on c.i.f. terms. This means that the seller pays cost, insurance and freight, and the buyer takes delivery *ex* ship. Payment is effected against draft with bill of lading and insurance certificate attached, drawn either at sight or 60

days or 90 days on the buyer's bankers. A local buyer situate at Durban may buy the cotton delivered f.o.b. (free on board) Beira or f.o.r. (free on rail) ginnery, paying nett cash against delivery.

Inasmuch as it will be four or six weeks before the cotton arrives at destination, the transaction will be based on "Futures" quotations for some months ahead. Thus if the cotton be sold for August or early September shipment "October" Futures, if for later shipment then "January" Futures will be taken. To quote an example: The cotton might be offered by cable, at 75 points "on" October Futures, prompt shipment, c.i.f. Liverpool, sight draft on A.1. London bank. If the offer is accepted the price may be fixed immediately on ruling Futures quotations, we might then have:—

October Futures	5.75d.
Basis	0.75d. "on"
Invoice price	6.50d.

Deducting from the c.i.f. basis of 75 points "on" the costs of freight, etc., which amount to about 65 points, at current prices, one arrives at the "basis" of 10 "on" f.o.b. Beira. Costs of shipment, railage from ginnery, commissions, etc., amount to approximately 55 points, which makes the "basis" f.o.r. ginnery 45 points "off" October Futures.

All these figures are approximate as they vary with different shipments, but they serve as an example of how the value of cotton may be determined at any given time. The figures all relate to value in pence and 1/100 of a penny (1 point) per lb. lint pressed into standard bales of about 500 lbs.

VALUATION OF COTTON.

The major factor in the valuation of cotton is, of course, its quality. This is determined (1) by grade, which denotes the cleanliness of the cotton; (2) by colour; (3) by staple, which includes length, strength and character of the cotton. The three factors, combined, make the value of the cotton.

Grade.—There are nine grades:—

M.F.	Middling fair.
S.G.M.	Strict good middling.
G.M.	Good middling.
S.M....	Strict middling.
M.	Middling.
S.L.M.	Strict low middling.
L.M.	Low middling.
S.G.O.	Strict good ordinary.
G.O....	Good ordinary.

The highest grade must be perfectly clean, without a speck of trash or foreign matter, and without any ginning blemish. As we descend the scale trash, foreign matter and blemishes increase, until we get down to Good Ordinary, which is extremely dirty cotton.

Colour.—When fully matured and healthy bolls of the cotton plant open, the cotton is of a fine white appearance. Discolouration may be caused by weather influence and/or insect depredations. This brings about a range of different colours, *i.e.*:

Good colour	=	white cotton, no discolouration.
Very lightly spotted	=	traces of yellow discolouration.
Lightly spotted	=	yellow spots fairly pronounced.
Yellow spotted	=	very definite yellow discolouration.
Yellow tinged	=	predominant yellow discolouration.

Discolouration materially affects the value of the cotton.

Staple.—A material factor in the valuation of the cotton is its length, strength and character. These factors depend largely on the variety grown and climatic conditions during any given season. The length of staple is expressed in inches, and in Southern Rhodesia ranges from 1 1/16th inch to 1 3/16th inch through the following scale:—1 1/16th, $1\frac{1}{8}$ inch, good $1\frac{1}{8}$ inch, full $1\frac{1}{8}$ inch, 1 3/16th inch, with material premiums for the longer staples over the shorter staples.

Grading.—Obviously the cotton must be graded in order that its various qualities may be described. For this purpose a representative sample has to be taken of each bale of lint. In the case of local buyers they have the opportunity of examining samples and satisfying themselves of the descrip-

tion. In the case of oversea buyers dealing on the strength of cabled descriptions of the quality, the grading has to be guaranteed and may be subject to arbitration in case of any dispute.

Ginning and Baling.—The separation of the fibre from the seed is accomplished by machines called "gins." Generally speaking cotton thirds itself (*i.e.*, one-third is fibre and two-thirds is seed). However in actual practice the "ginning percentage" may vary between 31 per cent. and 36 per cent. fibre, depending on cleanliness, the variety and seasonal conditions.

The ginned cotton, usually referred to as "Lint," is pressed into bales of about 500 lbs. weight, completely covered with hessian and bound with iron hoops. The charge for ginning has been established at 1d. per pound of lint. The service includes receiving, weighing, sorting and classification of the seed cotton, ginning, baling, sampling and despatching of the lint. The charge compares very favourably indeed with the charges in other parts of Africa.

Buying of Seed Cotton.—The development of native-grown cotton makes it imperative that facilities exist for the outright purchase of seed cotton for cash, at the fullest possible price, and wherever possible at a centre accessible to the native grower.

The buyer will classify the cotton and, as in all African territories, clean picking of native-grown cotton is insisted on, three grades are generally sufficient:—

Grade 1.—White, clean cotton.

Grade 2.—White cotton, slight trace of trash and discolouration.

Grade 3.—Discoloured cotton and/or trashy cotton.

With the latest Liverpool Futures quotation as a guide, the buyer knowing what quality the cotton will gin, can arrive at the f.o.r. ginnery value of the cotton. Deducting from this the cost of ginning and other charges and dividing the product by 3, or more correctly by the anticipated ginning percentage, the price payable per pound of seed cotton is arrived at. By hedging the cotton so purchased by a sale of

"Futures" the risk of market fluctuations can be insured against and the fullest market price paid the producer.

This review will have served its purpose if it has explained the various factors that go to determine the price of cotton, at any time and at any place. Marketing has been dealt with in its broadest outline only—the intricacies, technicalities and one may add, pitfalls, of Futures trading, grading, buying and selling have not been dealt with exhaustively, as this would lead far beyond the scope of a brief review.

SUMMARY.

1. The commercial value of cotton in any part of the world at any given time is governed by the world market price as expressed by quotation on the various "Cotton Futures" markets.
2. Of these, the Liverpool market is for us the ruling one, and in this review the Liverpool "American" Futures market is dealt with specifically.
3. In the Futures Contract place and time of delivery, quantity and quality are definitely fixed, which allows of free dealing, the only factor remaining to be agreed upon being that of price.
4. Dealings in Futures are generally concentrated on so-called trading months, which are: January, March, May, July and October, while the other months are rarely traded in.
5. Futures may be dealt in only on the floor of the Cotton Exchange, and only by members of the Liverpool Cotton Association, Limited, who act as brokers for non-members. Dealings are continuous from 10 a.m. to 4 p.m. daily, every transaction that involves a change in price being immediately recorded.
6. A purchase of a Futures Contract in a given position may be liquidated forthwith by a sale of the same position, the difference in price being paid over only.
7. The real function of the Futures Market is to provide those engaged in the cotton trade with facilities to insure their legitimate dealings in cotton against price fluctuations, by the method called "hedging."

In actual fact and practice virtually every purchase and sale of cotton is hedged and leads to a transaction in one or the other of the Futures Markets, which thereby becomes the final market where supply and demand meet.

8. In distinction to a "Futures" transaction, all transactions in actual cotton, whether the cotton be on the spot in Liverpool or afloat, or for immediate or forward delivery, are referred to as "Spot" transactions.

9. The value of any style of cotton is always thought of and expressed in relation to "Futures" quotations. Depending on its qualities it is either quoted "on" (stands at a premium) or "off" (stands at a discount). These differences are referred to as the "Basis."

10. With dealings in cotton the bargaining as to price takes place entirely in respect of the "Basis." The merchant will endeavour to buy the cotton at the lowest possible "basis," add his overhead expenses and expected profit, and sell at the highest possible "basis." It is immaterial to the merchant whether the basic Futures quotation be 5d. or 10d., the market a rising or a falling one, for he will cut out the risk of market fluctuations by hedging. Indeed, as trade is always stimulated by a rising market and high prices, the merchant would rather have such conditions than low prices or a falling market, usually an indication of stagnant or bad trade.

11. In arriving at the local value in Southern Africa, the cost of taking the cotton to the overseas market must be allowed for.

12. The quality and value of cotton is governed by:—(1) Grade. (2) Colour. (3) Staple.

13. Full market value for seed cotton can be paid the producer at any time, with the latest Liverpool Futures quotations available as a guide.

14. In this review cotton marketing has been dealt with in its broadest outline only; as to deal with its various aspects exhaustively would lead far beyond the scope of a brief review.

The "Gundry" Tobacco Furnace.

By B. G. Gundry, A.I.Mech.E.

Since particulars of this furnace were first published in 1934 it has been further tested at the Trelawney Tobacco Research Station, where it has given excellent results and attracted considerable attention. Very satisfactory results have also been reported by private growers who have tried it.

In order to overcome certain objections to the stoke hole being in the top of the furnace, as originally designed, an alternative design has been produced in which the stoke hole is situated in the front wall. As both designs have their respective advantages a drawing of each is reproduced herewith and for convenient reference these are designated as Types I. and II. The principle of their construction and working is, however, the same and there appears to be little, if any, difference in their general efficiency.

The important features of this furnace are its low fuel consumption, its cheap and easy construction and the ease with which the temperature can be controlled.

The Type I. furnaces installed at the Trelawney Station on 12 ft. x 12 ft. x 18 ft. barns fitted with 11 inch diameter circular flues, consumed on an average less than three-quarters of a cord* per curing over 14 curings. The consumption of a Type II. furnace installed on a standard 16 ft. x 16 ft. x 20 ft. barn also fitted with 11 inch diameter circular flues, averaged slightly over three-quarters of a cord in five curings. The highest consumption for either type of furnace reported by private growers was about 1¼ cords per curing.

Reports also state that with this furnace the temperature can easily be maintained at a steady figure and can, if necessary, be raised very rapidly.

*A cord of timber measures 8 ft. long x 4 ft. wide x 4 ft. high.

When used in conjunction with brick and iron flues it is unlikely that this furnace will give such good results as quoted above, as such flues are not so efficient as circular ones. It should, however, give a very considerably reduced consumption as compared with the ordinary open type of furnace.

Construction.—The furnace may be built at any convenient distance from the barn but it is not, as a rule, necessary or advisable for this distance to exceed 3 feet. Where a brick chimney is already in existence the furnace should be built fairly close to it and the flue taken through the base of the chimney. If more than a few inches of flue pipe is exposed between the barn and furnace it is advisable, in order to conserve the heat, to enclose it by building a low wall on either side of the pipe, an inch or so from it, and filling the space between with sand.

The excavation for the foundation should extend down to a firm compact formation and should not be less than 9 inches deep. The foundation should, for preference, be laid in lime or cement mortar, as these are far more permanent than "dagga." The top of the foundation should be not less than 3 inches above the ground level, but the height may be increased if necessary to suit existing conditions, such as the height of the barn floor or existing flues. In the drawing of the Type I. furnace it is assumed that the barn floor is only slightly above ground level and the flue is to be set about 7 inches above it. The Type II. furnace is drawn to suit conditions where the barn floor is about 9 inches above ground level and the flue is to be again 7 inches above it. It should be understood that the flue can be set at any convenient height in the back wall of the furnace which best suits the barn, but it is advisable to keep it below the top of the baffle wall.

When completed, the foundation will present a level platform of brickwork on which the walls are built. These should be build in "dagga" containing only sufficient clay to make it bind. If the "dagga" is naturally very rich it should have a certain amount of sand added to it to reduce the shrinkage. Care should be taken when laying the first course of bricks in the walls that the openings forming the air inlets are left in their proper places.

An opening, one or two bricks deep, should be left on one side opposite the space behind the baffle wall so that any ash which may collect there can be removed from time to time. This opening must, of course, be kept closed when the furnace is in operation by inserting loose bricks which should be plastered over with "dagga" to prevent the leakage of cold air into the flues.

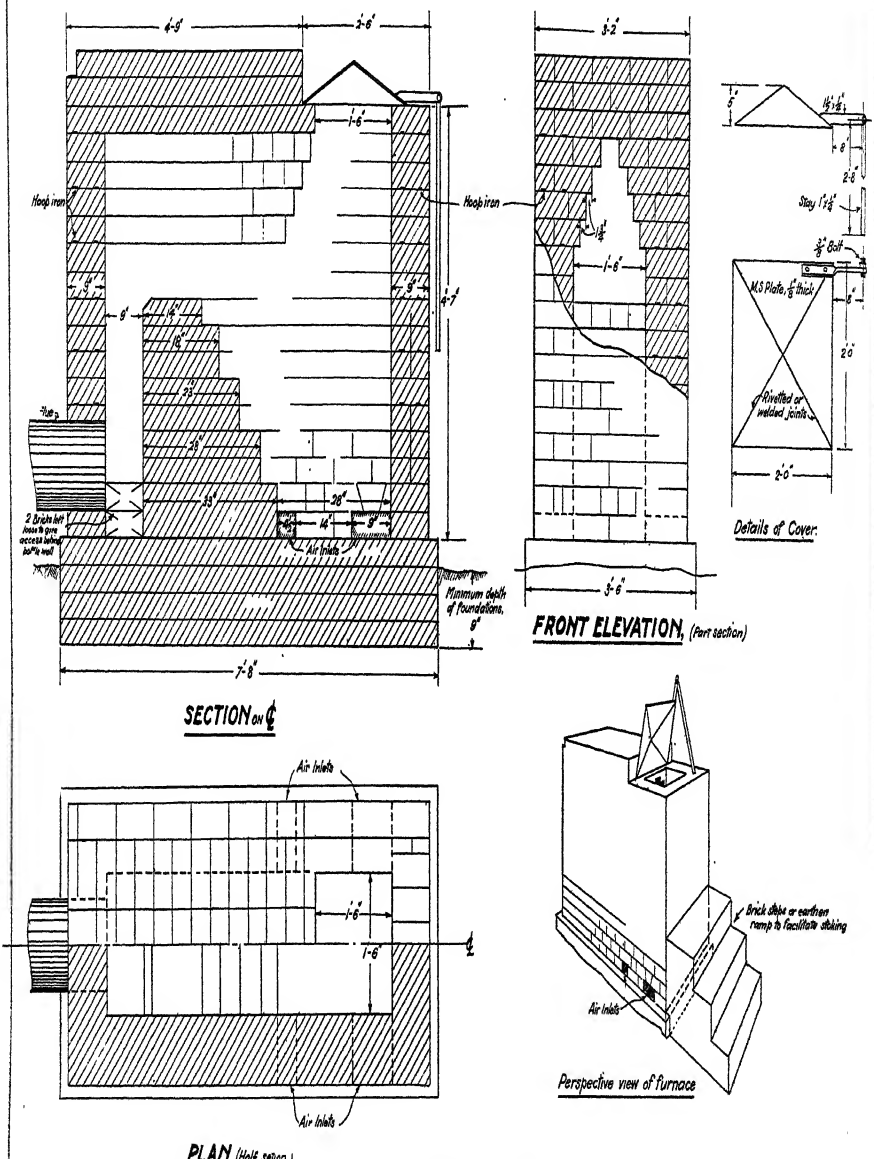
It should be noted here that the dimensions given on the drawing correspond to standard brick sizes, and if the bricks used are approximately of standard size there should be no need to cut them, except to make the usual "closers" to obtain a proper bond. It will be found, for instance, that the outer courses of the Type I. furnace will be 4 bricks wide by $9\frac{1}{2}$ bricks long, which will correspond very losely to the dimensions given, a difference of an inch or so will be of no importance.

When laying the second course of bricks the 9 inch air inlets should be covered by bricks cut to a "V" shape as shown in the drawing, and as a further safeguard against them collapsing pieces of thin sheet iron or a few lengths of hoop iron may be built in over these openings.

The inclined hearth and baffe wall should be built up with the side walls and should be bonded to them whenever convenient. The flue pipe is placed in position and built into the back wall at the required height. The walls should be build in "Colonial Bond," *i.e.*, three courses of "stretchers" and one course of "headers" alternately. When the fifth course has been laid two strands of barbed wire or strips of hoop iron should be laid in each second course of brickwork as indicated in the drawing. These will check the cracks which subsequently develop in the walls and prevent them becoming serious as well as strengthening the furnace generally.

It is advisable to carry similar wires or strips of hoop iron through each course of the baffle wall in the Type II. furnace in order to strengthen it.

When the walls reach the proper height the side walls are corbelled or stepped out towards the centre of the furnace to form the roof. It will be noted that in the first, second and



THE "GUNDRY"

TOBACCO FURNACE.

TYPE I

Scale 1 0 1 2 3 4 Feet

Irrigation Division
Dept of Agriculture
Salisbury

fourth course of corbelling, courses of "headers" have to be cut to the necessary length to give the required overhang of 1¾ inch. This overhang should not be appreciably increased otherwise the bricks will sag down when being laid and the ends may break off when the furnace is in operation. If any difficulty is experienced in laying these overhanging courses a straight piece of timber can be set up at the proper height to act as a support and guide for the bricks. When placing the two top courses on the roof care should be taken that each brick covers the joints below it.

It is very advisable to protect these furnaces from the destructive effects of rain either by a permanent corrugated iron roof supported on four poles or a loose cover which can be placed over them in wet weather.

Metal Work, Doors, Etc.—In order to obtain the maximum efficiency from either type of this furnace it is essential that the stoke hole be kept closed with a cover or door when it is not actually being stoked.

For the Type I. furnace a proper cast iron furnace door would be the most satisfactory, but as these are expensive something cheaper is usually adopted. A flat piece of iron plate ⅛ inch thick has proved fairly satisfactory, but such a cover warps and buckles after a time and admits too much air. A square, prism shaped cover as shown in the drawing has been tried at the Trelawney Station and appears to be more satisfactory than the flat plate, but it has not yet been thoroughly tested and readers are advised to try out one or two themselves before purchasing or making a large number of them. Some growers have found old plough discs quite satisfactory, if however these are used the size of the stoke hole will have to be reduced to about 14 inches square, by corbelling out the two top courses of brickwork. A strong wire loop is attached to the disc so that it can be lifted on and off with a stick or iron bar. The Type II. furnace requires a door hinged either at the top as shown in the drawing or, if preferred, one hinged at the side. It is probable that a door hinged at the top and having to be propped open is more likely to be kept closed when the fire is not being stoked.

Here again a cast iron door would be the most satisfactory, but in this type the door is not subjected to such intense heat as in the Type I. furnace, and at the Trelawney Station a door of $\frac{1}{8}$ inch plate has served its purpose quite well.

The only other metal work required is an iron sill placed on the bottom of the stoke hole opening. This is necessary to protect the brickwork from being broken away by the logs as they are pushed into the furnace. Two strips of old tyre iron would be quite suitable for the purpose.

Operating.—When the furnace has been built it should be left to dry out for a few days. It should then be given a trial to see that it works satisfactorily. A small fire should be lighted and the air inlets left open until the fire is burning freely and the chimney is "drawing." The air inlets may then be almost entirely closed with loose bricks so that the fire burns steadily. It is advisable to keep only a small fire going for several hours to dry out the furnace.

The fire can then be increased and the temperature gradually raised to the maximum required. It may be necessary to open the air inlets slightly, but it is rather amazing to find what a very small amount of air has to be admitted to maintain a large fire.

The size of the fire required to maintain any given temperature will depend on the prevailing atmospheric conditions and the efficiency of the flues and chimney. At the Trelawney Station, where the barns are fitted with circular iron flues and chimneys, it is seldom necessary to have the furnaces more than half full of fuel to obtain the maximum temperature. If any difficulty is experienced in getting the barns hot a careful examination of the flues and chimney should be made to make sure that there are no obstructions in the system or that the flues are not thickly coated with soot or tar. It sometimes happens that in the angles or tee pieces of the flues one section is pushed too far into the other, thus restricting the passage of hot air, or again the flue leading to the chimney may be pushed too far into the chimney opening with the same result.

The Type I. furnace is fed by lowering the logs vertically through the stock hole and allowing them to fall backwards on to the inclined baffle wall. The logs should not exceed 4 feet in length. In the Type II. furnace the logs should lie on the inclined hearth below the stoke hole.

If it is necessary to reduce the temperature it should be done by closing the air vents partially or completely as circumstances require and *not*, except in an emergency, as the average fire boy likes to do, by leaving the stoke hole open. It will be necessary to clear the air inlets occasionally with a small iron rake, but only dead ash should be removed, care being taken not to rake out the live charcoal. At the end of a curing all the ash should be removed from the furnace.

Soon after first lighting the fire, cracks almost invariably develop in the side walls, these should be closed up with "dagga" and will not, as a rule, give any further trouble.

This furnace is not suitable for burning very large logs or large awkward shaped roots.

SOUTHERN RHODESIA.

Locust Invasion, 1932-36.

Monthly Report No. 43. June, 1936.

Few reports of locusts have been received during the month, and these have referred only to the Red Locust (*Nomadacris septemfasciata*, Serv.).

The last hoppers were destroyed or developed wings early in the month.

Winged swarms have been reported from the districts of: Charter, Hartley, Chibi, Victoria, Mazoe, Lomagundi, Salisbury and Mrewa. Most of these have been described as of "small" or "medium" size, but one swarm seen in the north of the Lomagundi district on the 20th was described as "large."

The position appears to have been very similar to that during June last year, except that the swarms have been smaller.

RUPERT W. JACK,
Chief Entomologist.

Southern Rhodesia Veterinary Report.

MAY, 1936.

AFRICAN COAST FEVER.

Disease was diagnosed on Melfort Estate in the Salisbury native district, and on Seaborough farm, in the Bulawayo native district.

MALLEIN TEST.

Sixty horses, 22 mules and 31 donkeys were tested upon entry. No reaction.

TUBERCULIN TEST.

Thirty-eight cows with negative results.

IMPORTATIONS.

From Union of South Africa.—38 cows, 55 horses, 22 mules, 725 sheep.

From Bechuanaland Protectorate.—5 horses, 31 donkeys, 625 sheep.

EXPORTATIONS.—MISCELLANEOUS.

To United Kingdom in Cold Storage.—Chilled beef quarters, 7,317; frozen boned beef quarters, 2,087; frozen beef quarters, 5,422; briskets, 1,194 lbs.; shoulders, 8,528 lbs.; middles, 2,705 lbs.; buttocks, 7,417 lbs.; kidneys, 1,542 lbs.; tongues, 11,267 lbs.; livers, 23,602 lbs.; hearts, 10,601 lbs.; tails, 5,015 lbs.; skirts, 6,210 lbs.; shanks, 7,348 lbs.

Meat Products.—From Liebig's Factory.—Corned beef, 21,600 lbs.; meat extract, 22,887 lbs.; beef powder, 102,969 lbs.; beef fat, 49,300 lbs.; meat meal, 32,000 lbs.; tongues, 3,960 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

JUNE, 1936.

Pressure.—Mean barometric pressure was above normal for the month. Very few lows affected the country during the month.

Temperature.—Mean temperatures were rather low. During the first week of the month very low minimum temperatures were recorded and there was a good deal of frost.

Rainfall.—A little rain fell in practically all parts of the country, but the total amounts were small, except over the Eastern Border.

JUNE, 1936.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Normal	Temperature in Stevenson Screen °F. Absolute. Max.	Absolute. Min.	Mean. Max.	Mean. Min.	½ Max. Min.	Nor-mal.	Dry Bulb.	Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt 0-10	Precipitation Ins.	Nor-mal	No. of Days	Alti-tude (Feet)
Angus Ranch... ...	...	...	78	42	72.7	50.6	61.6	61.6	59.5	55.4	78	45	...	0.56	0.12	5	...
Beitbridge...	973.6	...	84	36	76.3	46.8	61.6	...	57.9	52.4	69	48	1.6	0.00	0.00		1,500
Bindura...	897.7	...	77	35	71.2	46.7	59.0	...	57.4	51.9	69	47	1.8	0.18	0.02	2	3,700
Bulawayo	874.9	873.1	75	34	67.4	44.2	55.8	57.3	54.7	49.2	68	44	2.0	0.01	0.03	1	4,426
Chipinga	899.3	...	73	41	65.4	48.9	57.1	...	57.1	54.0	83	52	4.8	3.02	0.41	9	3,685
Enkeldoorn...	863.2	...	74	35	66.2	44.4	55.3	57.4	53.9	49.4	74	46	3.1	0.00	0.03		4,788
Fort Victoria	902.9	901.0	75	33	67.5	43.6	55.5	55.0	54.5	50.9	78	48	3.5	0.22	0.07	3	3,571
Gwaai Siding	910.9	...	83	32	76.5	40.8	58.7	...	54.3	48.7	67	44	1.4	0.00	0.00		3,278
Gwanda...	914.0	...	77	32	69.5	43.6	56.6	...	53.5	49.8	77	47	2.8	0.14	0.06	3	3,233
Gwelo	868.4	..	74	34	66.6	44.2	55.4	57.1	52.7	48.6	75	45	2.9	0.07	0.02	2	4,629
Hartley...	891.7	...	78	33	72.0	43.0	57.5	59.0	55.7	50.7	70	42	2.3	0.01	0.00	1	3,879
Inyanga...	841.7	...	74	30	64.9	41.8	53.4	...	55.2	48.2	61	42	1.9	0.46	0.05	5	5,503
Marandellas	842.8	...	72	37	64.5	44.2	54.4	...	52.7	48.2	73	44	2.8	0.11	0.06	2	5,453
Miami	884.6	..	76	37	70.3	46.8	58.5	...	57.2	52.7	74	49	3.0	0.02	0.02	1	4,090
Mount Darwin ...	913.4	...	78	33	73.6	45.0	59.3	..	59.4	54.7	74	52	2.9	0.07	0.03	1	3,179
Mount Nuza	805.6	...	58	33	51.9	40.1	46.0	...	45.5	43.9	88	43	6.4	1.40	..	11	6,668
Mtoko	883.0	...	73	38	69.4	48.1	58.7	...	58.5	52.8	68	48	1.3	0.11	0.00	3	4,141
New Year's Gift. .	...	...	80	42	71.4	49.4	60.4	...	57.3	53.9	80	52	..	1.17	0.23	7	2,690
Nuanetsi	971.1	...	83	35	75.1	45.5	60.3	...	59.3	54.9	76	52	2.8	0.25	0.05	2	1,581
Plumtree	870.5	...	74	35	67.5	46.7	57.1	..	55.6	49.5	65	44	0.9	0.03	0.00	1	4,549
Que Que	888.1	...	79	37	71.0	45.6	58.3	...	56.4	50.9	69	47	3.3	0.00	0.00	.	3,999
Rusape	868.0	...	73	31	65.5	42.5	54.0	.	52.1	49.2	82	47	3.4	0.57	0.11	4	4,648
Salisbury	861.7	858.8	77	33	69.9	43.2	56.6	57.1	56.0	50.1	66	45	1.6	0.03	0.05	2	4,885
Shabani...	917.8	...	77	37	69.8	46.2	58.0	..	57.0	53.0	77	50	4.1	0.26	0.11	5	3,131
Sinoia	894.5	..	81	31	74.2	41.4	57.8	...	57.1	51.4	68	47	1.9	0.06	0.02	1	3,795
Sipolilo	891.1	...	76	37	71.3	47.5	59.4	...	60.1	53.2	63	48	1.9	0.00	0.02	. .	3,876
Stapleford	847.5	...	64	26	...	38.6	...	...	50.0	48.4	90	47	4.9	1.44	0.64	10	5,304
Umtali...	899.7	897.9	75	39	68.4	47.2	57.8	59.9	56.3	53.8	85	52	4.2	0.68	0.21	7	3,672
Victoria Falls... ...	...	...	...	...	...	...	...	...	...	...	...	..	..	0.00	0.01	..	3,009
Wankie	934.0	...	87	45	79.3	54.2	66.7	...	60.4	53.0	61	47	1.7	0.08	0.00	2	2,567

Southern Rhodesia Weather Bureau.

JUNE, 1936.

Pressure.—Mean barometric pressure was above normal for the month. Very few lows affected the country during the month.

Temperature.—Mean temperatures were rather low. During the first week of the month very low minimum temperatures were recorded and there was a good deal of frost.

Rainfall.—A little rain fell in practically all parts of the country, but the total amounts were small, except over the Eastern Border.

JUNE, 1936.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt	Precipitation			Altitude
			Absolute.		Mean.												(Feet)
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch	...	...	78	42	72.7	50.6	61.6	61.6	59.5	55.4	78	45	...	0.56	0.12	5	...
Beitbridge	973.6	...	84	36	76.3	46.8	61.6	...	57.9	52.4	69	48	1.6	0.00	0.00	.	1,500
Bindura	897.7	...	77	35	71.2	46.7	59.0	...	57.4	51.9	69	47	1.8	0.18	0.02	2	3,700
Bulawayo	874.9	873.1	75	34	67.4	44.2	55.8	57.3	54.7	49.2	68	44	2.0	0.01	0.03	1	4,426
Chipinga	899.3	...	73	41	65.4	48.9	57.1	...	57.1	54.0	83	52	4.8	3.02	0.41	9	3,685
Enkeldoorn	863.2	...	74	35	66.2	44.4	55.3	57.4	53.9	49.4	74	46	3.1	0.00	0.03		4,788
Fort Victoria	902.9	901.0	75	33	67.5	43.6	55.5	55.0	54.5	50.9	78	48	3.5	0.22	0.07	3	3,571
Gwaai Siding	910.9	...	83	32	76.5	40.8	58.7	...	54.3	48.7	67	44	1.4	0.00	0.00		3,278
Gwanda	914.0	...	77	32	69.5	43.6	56.6	...	53.5	49.8	77	47	2.8	0.14	0.06	3	3,233
Gwelo	868.4	..	74	34	66.6	44.2	55.4	57.1	52.7	48.6	75	45	2.9	0.07	0.02	2	4,629
Hartley	891.7	...	78	33	72.0	43.0	57.5	59.0	55.7	50.7	70	42	2.3	0.01	0.00	1	3,879
Inyanga	841.7	...	74	30	64.9	41.8	53.4	...	55.2	48.2	61	42	1.9	0.46	0.05	5	5,503
Marandellas	842.8	...	72	37	64.5	44.2	54.4	...	52.7	48.2	73	44	2.8	0.11	0.06	2	5,453
Miami	884.6	...	76	37	70.3	46.8	58.5	...	57.2	52.7	74	49	3.0	0.02	0.02	1	4,090
Mount Darwin	913.4	...	78	33	73.6	45.0	59.3	..	59.4	54.7	74	52	2.9	0.07	0.03	1	3,179
Mount Nuza	805.6	...	58	33	51.9	40.1	46.0	...	45.5	43.9	88	43	6.4	1.40	...	11	6,668
Mtoko	883.0	...	73	38	69.4	48.1	58.7	...	58.5	52.8	68	48	1.3	0.11	0.00	3	4,141
New Year's Gift	...	...	80	42	71.4	49.4	60.4	...	57.3	53.9	80	52	.	1.17	0.23	7	2,690
Nuanetsi	971.1	...	83	35	75.1	45.5	60.3	...	59.3	54.9	76	52	2.8	0.25	0.05	2	1,581
Plumtree	870.5	...	74	35	67.5	46.7	57.1		55.6	49.5	65	44	0.9	0.03	0.00	1	4,549
Que Que	888.1	...	79	37	71.0	45.6	58.3	...	56.4	50.9	69	47	3.3	0.00	0.00	..	3,999
Rusape	868.0	...	73	31	65.5	42.5	54.0	.	52.1	49.2	82	47	3.4	0.57	0.11	4	4,648
Salisbury	861.7	858.8	77	33	69.9	43.2	56.6	57.1	56.0	50.1	66	45	1.6	0.03	0.05	2	4,885
Shabani	917.8	...	77	37	69.8	46.2	58.0	...	57.0	53.0	77	50	4.1	0.26	0.11	5	3,131
Sinoia	894.5	...	81	31	74.2	41.4	57.8	...	57.1	51.4	68	47	1.9	0.06	0.02	1	3,795
Sipolilo	891.1	...	76	37	71.3	47.5	59.4	...	60.1	53.2	63	48	1.9	0.00	0.02	..	3,876
Stapleford	847.5	...	64	26	...	38.6	...	...	50.0	48.4	90	47	4.9	1.44	0.64	10	5,304
Umtali	899.7	897.9	75	39	68.4	47.2	57.8	59.9	56.3	53.8	85	52	4.2	0.68	0.21	7	3,672
Victoria Falls	...	...	...	...	...	...	...	...	..	...	...	...	..	0.00	0.01	...	3,009
Wankie	934.0	...	87	45	79.3	54.2	66.7	...	60.4	53.0	61	47	1.7	0.08	0.00	2	2,567

Farming Calendar.

AUGUST.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-working to better varieties. As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents. Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal*. Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis, or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and,

if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farm-yard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillers. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, 1¼ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given for potatoes with the addition of ½ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add tobacco extract, 1 part to 80 parts spray. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage,, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses. etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas, as most poultry keepers know. are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should be treated every week in one of the following ways:—(1) Thorough soaking with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible. and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

SEPTEMBER.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (with a pinch of salt and a dash of vinegar) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cynaide—both requiring very careful handling. If it is wanted to increase the apiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcasted and ploughed or harrowed in can be applied. Do not forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vlei lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roller can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought out and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and 21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30 yards in all directions, and bait this ground thoroughly before sowing—this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1-100) may be used to control yellow citrus thrip whilst on every young fruit. A useful spray against black aphis and thrip is the following:—Nictone, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenuous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuce, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for killing. Keep the best and get rid of the remainder. It is very advisable to caponise all young cockerels when about 2½ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to 5½ months old, or a heavy breed until it is 6 to 6½ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Maize Conference.—The Minister of Agriculture has, with the approval of the Cabinet, called a conference to be held in the Legislative Assembly Building at 9.30 a.m., on Tuesday, 8th September, in order that all sections of the maize industry may express their views regarding maize control. It is not proposed that the conference shall endeavour to come to any final decision regarding maize control but rather that it will afford an opportunity for the representatives of the various agricultural bodies to represent to the Government the feeling and wishes of the various parts of the country. It is hoped that the discussions which take place will enable the Government to decide whether maize control in its present form is to be continued; whether it should be continued in

some altered form or whether it should be discontinued. The delegates to the conference will comprise all members of the Maize Control Board, four members of the Board of Directors of the Farmers' Co-op Ltd., Salisbury; two representatives of the Midland Farmers' Agricultural Union, Gwelo; two representatives of the Fort Victoria Farmers' Co-op. Society; two representatives of the Matabeleland Farmers' Co-op., Ltd., Bulawayo; two representatives of the Rhodesia Agricultural Union; two representatives of the Eastern Farmers' Federation, Umtali; two representatives Midlands Farmers' Co-op., Gwelo; and two representatives from the Matabeleland Farmers' and Landowners' Union, Bulawayo.

Sheep.—During the last few years there has been a very marked improvement in sheep throughout the Colony, largely due to the special attention which is being given by the Animal Husbandry branch. It was recognised that the main troubles were due to parasitic worms and faults in management. The woolled sheep on the Eastern Border have certainly improved, and it is gratifying to note that the interest in the Blackhead Persian type of sheep in all parts of the Colony has greatly increased. An officer of the Animal Husbandry branch is at present visiting the Union to purchase rams and ewes on behalf of farmers, for which purpose the farmers have provided £1,000.

Dairy Regulations.—Attention is drawn to the dairy regulations which were published in Government Notice 502 during July under the Dairy Control Act, 1931.

After a date to be fixed by the Minister by notice in the *Gazette*, no premises may be used for the production of milk or cream for sale to a cheese factory or creamery, or for the manufacture of farm butter or cheese (referred to in the regulations as a "Dairy," "Farm Butter Dairy," and "Farm Cheese Dairy," respectively) unless such premises are registered with this Department.

Any person who wishes to use any premises as a dairy, farm butter dairy or farm cheese dairy must apply for the registration of such premises to the Secretary, Department

of Agriculture and Lands. On receipt of such application for registration the premises will be inspected by an Inspector from this Department.

If any person therefore wishes to use any premises for any of the purposes specified above, it will be necessary to apply for the registration of such premises to this Department; a form for this purpose, together with a franked envelope in which to forward the application for registration, can be had on request.

It should be noted that if any premises are to be used for the production of milk or cream for sale to a cheese factory or creamery, then application should be made for the registration of the premises as a "Dairy"; if the premises are to be used for the manufacture of farm butter or cheese then application should be made for the registration of the premises as a "Farm Butter Dairy" or "Farm Cheese Dairy."

Amendment of the Standard Weight of Ground Nuts.—The official standard weight of a bag of unshelled ground nuts has, since 1924, been 75 lbs. nett. With the kinds usually grown, however, it was often found that it was impossible to get this weight into a bag without first stitching an extra strip on the top. This was commonly the case with native grown nuts. On this account a request was received from the Rhodesia Agricultural Union to the effect that the Government be approached with a view of reducing the standard weight of a bag of unshelled ground nuts from 75 lbs. nett to 65 lbs. nett. Local trade interests were consulted and it was generally agreed that under present conditions and since the trade in native grown nuts has increased considerably in recent years the change suggested was desirable. His Excellency the Governor-in-Council has been pleased in terms of Section 46 of the Weights and Measures Act, 1924, to make the necessary amendment which was published as Government Notice No. 585 of 1936.

Cost of Importing Pedigree Stock from the United Kingdom.—Numerous enquiries have been received from farmers regarding the costs and charges involved in importing pedigree stock

from the United Kingdom. It may be of interest therefore to give in detail the costs of importing a pedigree Red Poll bull for the Rhodes Matopos Estate in March last. The expenses shown do not include the commission paid for the selection of the bull in England nor the rail charges from Salisbury to destination after inoculation for redwater and gall-sickness. The former may vary from a few pounds up to twenty pounds per head, depending upon the number of cattle, the amount of travelling involved and other circumstances. The railage on a single bull from Cape Town to Salisbury is £17 1s. 6d., but a rebate of £8 10s. 0d. is granted when the certificate of registration in the South African Stud Book is produced.

	£	s.	d.
Tuberculin test	£1	1	0
Quarantine expenses—			
Railage to quarantine station	1	10	0
Fees and incidentals	7	17	6
Transport to vessel	0	5	0
Freight and freight charges...	24	16	6
Agency fees	0	12	3
**Insurances (all less* 10%)—			
To cover voyage, 4 guineas% of amount insured			
To cover tuberculosis test 2% of amount insured			
To cover redwater and gall-sickness inoculation 2% of amount insured...	21	5	11
To cover twelve months after arrival in Southern Rhodesia 6% of amount insured			
Policy and stamp	0	1	0
Agency and forwarding charges	5	1	4
Railage Cape Town to Salisbury (less rebate	8	11	6
Total	£71	2	0

*Total insurances amount to approximately 14% of the amount for which the animal is insured.

Review and Commentary.

"The Scientific Principles of Plant Protection," by Herbert Martin, D.Sc. (Lond.), A.R.C.S., F.I.C. Pub. by Edward Arnold & Co., London. Second Edition, 1936.

We welcome the appearance of a second and enlarged edition of Dr. Martin's work, the first edition of which appeared in 1928.

The literature dealing with the sciences of applied entomology and plant pathology is not only voluminous and scattered, but the rate of production is increasing year by year. Both these sciences are of modern growth and the concentration of accumulated data into a scientific treatise on the whole subject of plant protection has been the natural corollary to the remarkable progress made in these sciences, more particularly since the beginning of the present century, with increasing momentum to the present day.

It is to be realised, however, that whilst insect pests and plant diseases cause conspicuous injuries to cultivated plants, which consequently need direct protection from such enemies, the problem of plant protection as a whole involves most of the agricultural sciences, including chemistry, physics, botany, zoology, agronomy, genetics, etc.

In his preface to the present edition, Dr. Martin states that he has dealt in greater detail with the physico-chemical aspects of the plant protection than with the biological aspects, a fact which is apparent from the number of pages dealing with chemical and physical methods when compared with the total number of pages in the book. The former amount to two hundred and fifty-six pages, out of a total of three hundred and forty-eight.

It is, however, admitted, and in fact stressed, that effective use of chemical and physical methods depends entirely on accurate biological data, so that no one branch of science is in reality more important than another. All branches are, in fact, inter-dependent in their application to the protection of plants.

In this connection it may perhaps be of interest to note that a research worker of long experience* in a very recent paper contributed to the *Empire Cotton Growing Review*, July, 1936, expresses a very definite opinion that plant protection, and incidentally the protection of animals from disease, is almost entirely a matter of nutrition and genetics, all other sciences being of minor importance. He is particularly severe on the use of sprays and powders and describes such procedure as thoroughly unscientific and radically unsound. Whilst there is undoubtedly a germ of truth in certain of his contentions, it is felt that few workers in agricultural science will endorse in their entirely sweeping generalisations to the above effect.

The world owes a very great deal to the discovery of chemical methods of controlling plant pests, and one is led to ask how a plant, however well nourished and adapted to its environment, will protect itself against, say, a swarm of locusts or a horde of leaf-eating caterpillars.

Reliable estimates of the total losses incurred annually in the world through the depredations of pests and diseases on cultivated crops amount to many millions of pounds annually, and Dr. Martin furnishes certain figures of this nature.

Same may incline to the opinion that at the present day, when the word "over production" is in everyone's mouth, the world can well afford to be without the food and other produce involved in these figures.

Even if we admit, however, that the present low prices for agricultural produce are due to over production and not to imperfect distribution, the problem of plant protection still retains its outstanding importance.

In the first place, the proportion of crops destroyed by pests represents so much waste of human labour and money which, notwithstanding the unemployment figures, could be certainly applied to useful or, at the very least, health-promoting purposes.

Secondly, the incidence of pests and disease is excessively uneven in respect to the individual grower. Apart from any

*Sir Albert Howard, C.I.E.

protective measures which may be adopted by one grower and not by another, there is a great element of what appears to be chance, but is no doubt the product of unknown and largely uncontrolled factors, in the attack of pests. The direction of the wind, the distribution of humidity, the natural flora of the locality, and a host of obscure influences are involved. Consequently, the total annual injury is not distributed equitably over all the growers, but represents heavy loss to some and insignificant loss to others.

Finally, at the present period of low prices for agricultural produce, it is obvious that no commercial grower can afford to waste labour and money if it is avoidable. The attack of pests and disease may make all the difference between profit and loss on the undertaking, and in any case, it is obvious that any profit made would be materially larger, other things being equal, if pests and disease were non-existent.

The aim of plant protection is to ensure as far as is humanely possible that the grower reaps the crops which he plants. The result need not be over production, but more economical production. If a lesser amount of labour and outlay will supply the world's demand for foodstuffs and other agricultural products, the effect cannot be other than beneficial to the producer.

Dr. Martin's book is written primarily for the guidance of agricultural officers and research workers. As far as chemical methods of plant protection are concerned, it may be regarded as covering the ground in a very thorough and highly informative manner. Other methods which may eventually prove to be more valuable are much more briefly reviewed, but it must be admitted that in the present stage of knowledge chemical methods are much the most widely applicable and the most generally utilised, and it is doubtful if they will ever be altogether superseded. The book, in co-ordinating a vast amount of scattered information not otherwise readily accessible, constitutes a valuable addition to current literature on the subject of plant protection. It is an essential addition to the libraries of all agricultural institutions.

R.W.J.

CITRUS DISEASES AND THEIR CONTROL, Second Edition, by Howard S. Fawcett. XV.+656 pps., illustrated. McGraw-Hill, London and New York, 1936.

The new edition of Prof. Fawcett's book on citrus diseases will be welcomed by all professional plant pathologists, horticulturists and students interested in citrus culture. The first edition has been generally adopted as a standard reference book on citrus diseases for the past ten years, and now, the second edition, enlarged and brought up to date, can well uphold the prestige of its parent.

The arrangement of the subject matter has followed on the lines of the first edition, starting with chapters of a general nature, gradually leading up to detailed descriptions and discussions of numerous specific diseases, classified according to their most conspicuous features, such as root and trunk diseases, eruptive diseases, fruit rot, etc. A diagnostic key is provided to each section based on symptoms as in the previous edition.

The first two chapters on the history of citrus disease investigations and description of *Citrus* spp. and varieties, with their common names, naturally lead up to Chapter III., in which the nature of fungi and their relation to diseases are described for the layman and the student.

The knowledge thus gained is then expanded in a discussion of the geographical distribution of citrus diseases in Chapter IV. This chapter shows how widespread is the cultivation of citrus, whilst the records of diseases indicate in an interesting manner the relative importance of the crop in different countries. The information presented has in most cases been communicated by local plant pathologists, and brings together in concise form all the major and most of the minor known diseases of citrus. In this way a number of relatively unimportant, but nevertheless interesting, or

maybe confusing, diseases are described,, which might otherwise never have appeared in print. Prof. Fawcett is to be congratulated on his energy and breadth of vision in inviting such contributions from workers in other lands.

Chapter V., dealing with "contributory" conditions in general, is obviously written for the student or layman, as the explanation of fungal mechanism in terms of everyday objects shows. It is to be wondered whether these ingenious explanations ever do convey a clear-cut picture to the "practical man," and whether equally ingenious illustrations would not be of assistance.

Part I. concludes with two chapters of a practical nature on fungicides and cultural operations.

Part II. deals in intimate detail with various specific diseases, both parasitic and non-parasitic. There are many additions in this section, notably water rot, areolate spot, bark blotch, sweet orange fruit scab. Australian citrus scab, Valentia rind spot, rind breakdown, Clitocybe root rot, cotton root rot, Ganoderma root rot, Ascochyta blight, red root disease, infectious mottling, xyloporosis, little leaf and Bordeaux injury, whilst recent work on earlier-described diseases is given prominence.

Room is also found for adequate descriptions of the organisms and diseases associated with Rhizoctonias of the *lamellifera* and *bataticola* types, fungi whose economic importance is only now attracting the attention of mycologists in various parts of the world. Modern work on the effects of mineral deficiency is also included.

Seventy-eight pages are devoted to true fruit rots, including a full description of *Diaporthe citri*, and 91 pages to external blemises of parasitic and non-parasitic origin.

The final chapter deals at length with causes and remedies of breakdown of fruits in storage. This discussion is almost entirely confined to considerations of lemons from California

and Florida, and a sense of disappointment is felt that the international atmosphere of the rest of the book is not maintained in the last chapter.

A very full up-to-date bibliography of 40 pages with reference as late as 1935 concludes the volume.

The book is one of the well known Agricultural and Botanical Sciences series and well up to the usual standard in quality of paper and printing.

The illustrations are numerous and exceptionally clear, the 12 coloured plates being of a high order of excellence. In a great many instances diseases can be diagnosed simply by comparison with the illustrations in the book.

Prof. Fawcett is to be congratulated on giving to professional plant pathologists, growers and students alike a reference book of great value.

J.C.F.H.

Some of Mr. Hanmer's Merinos on Fairview, Melsetter.

Sheep Management on the Mixed Farm.

By R. H. Fitt, Animal Husbandry Officer.

This article is intended to serve as an introduction to the care and management of sheep on the middle veld and low veld areas of this Colony. Most of this Colony is at present unsuited to woolled sheep on account of the prevalence of various grasses which have piercing seeds, such as "Assegai" grass (*Heteropogon contortus*) and "Stiek" grasses (the *Aristidas*), also to the untamed condition of the grazing. Only on the high veld areas such as Melsetter will the woolled sheep do well. It is the intention to deal with the management of woolled sheep in a subsequent article, and the present notes are therefore confined to non-woolled and similar allied types which are at present found on mixed farms.

Sheep farming in this Colony has not hitherto been generally successful. Mismanagement due not only to lack of knowledge and experience but also to lack of interest has been the general cause of failure. Losses from internal parasites have also been heavy. The recent improvements made in the methods of the control of parasites have however made it possible to control even the most persistent species.

The Sheep Farm.—*The Farm.*—The first question to consider is the suitability of the farm for sheep. To attempt to run sheep on a farm which is unsuitable will produce the inevitable result—failure. Farms comprising large wet vlei areas and little dry land are unsuitable, as are also those which though dry in the winter months become soggy and waterlogged during the summer. A well drained farm, free from surface water is most favourable, provided the grazing is in a "tamed condition," and under such conditions the type of soil makes no material difference.

Buildings and Shelter.—Non-woolled sheep require some overhead shelter in the parts of this Colony where cold wet nights are experienced. Nothing very elaborate is necessary; a good roof with a wall along the weather side is quite sufficient. It is important, however, that the shelter is sufficiently large to prevent crowding, as this is liable to bring on pneumonia.

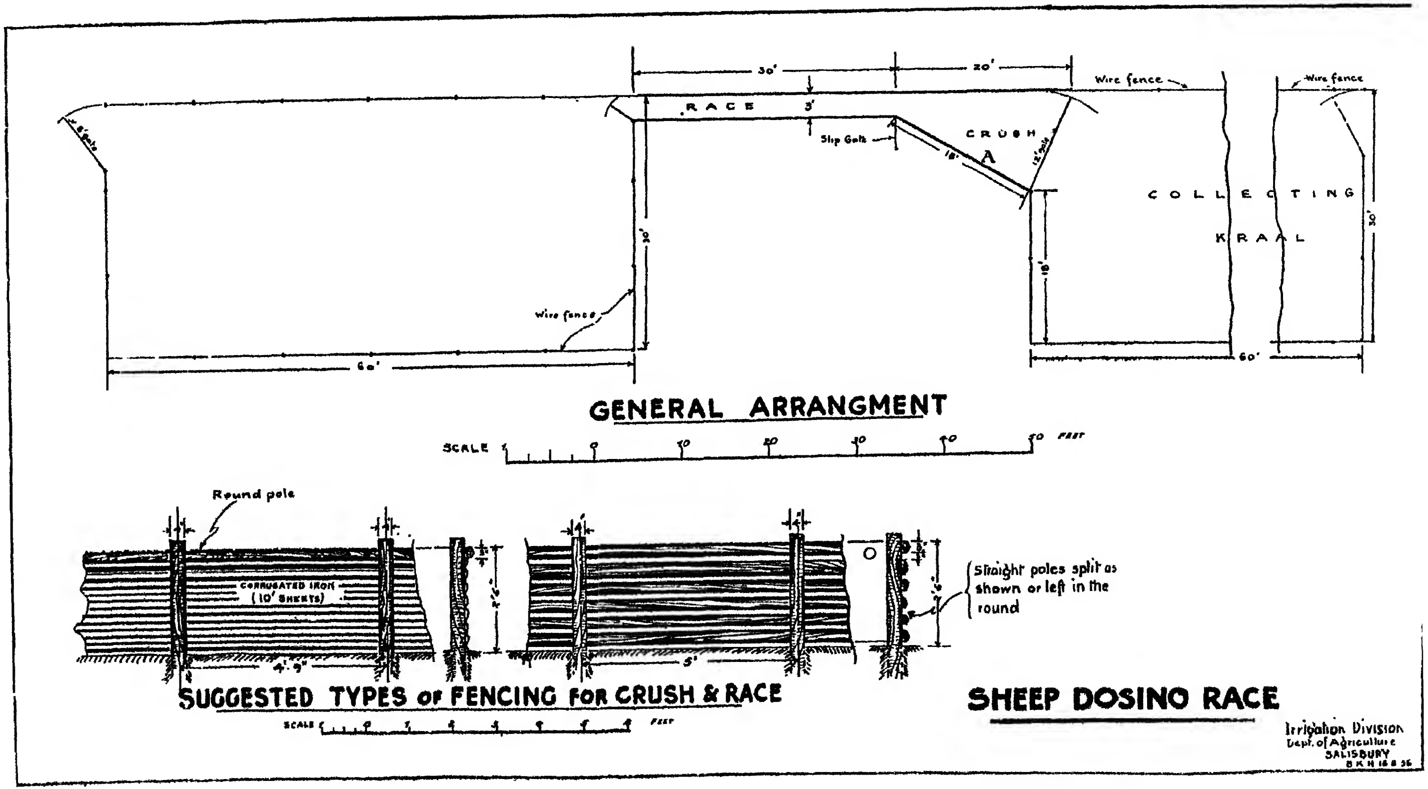
In well wooded low veld areas sufficient shade and protection is provided by nature. In exposed treeless areas trees should be planted to afford shelter and shade. Shelter is essential on lambing grounds and in lambing paddocks.

Fencing.—The regulation five-wire fence is unsatisfactory for non-woolled sheep. The least that can be used is three wires above two feet of pig netting or seven tightly strained wires with droppers closely spaced.

Yards.—A yarding system is necessary not only to assist classing and culling but also dosing. A simple yarding system with a small dosing race combined is shown in the illustration. Dosing with the assistance of a race reduces the handling of sheep to a minimum and also makes the dosing of even a large number of sheep a quick and easy business.

Water.—This is one of the most important factors in flock management. Good clean drinking water is essential. The best water for sheep is that which comes from a well or borehole and is led into drinking troughs. These troughs should be cleaned out at least once every two weeks. The growth of algae can be checked by adding bluestone at the rate of 1 oz. to 3,000 gallons. Care must be taken to prevent the ground surrounding the troughs from becoming muddy. This can be done by paving with large stones or gravelling. It is through mud adhering to the animal that some parasites enter the sheep by piercing a way through the skin.

If the sheep have to drink at running streams, care must be taken to arrange that the sheep do not drink from muddy banks, also that they do not linger at the water's edge grazing on the grassy banks. These damp places are the favourite haunts of the larvae of many species of internal parasites. Drive the sheep to water together, driving them away directly they have finished drinking. During rainy weather sheep will often not require to drink.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50 FEET
Round pole
CORRUGATED IRON
(10' SHEETS)
4' 9"
5'
Straight poles split as shown or left in the round
SUGGESTED TYPES OF FENCING FOR CRUSH & RACE
SCALE
FEET
SHEEP DOSINO RACE
Irrigation Division
Dept. of Agriculture
SALISBURY

Satisfactory drinking facilities from a dam can be provided by running a pipe line through the dam wall to a trough some distance away on dry ground. The dam itself should be fenced to prevent the sheep from polluting the water.

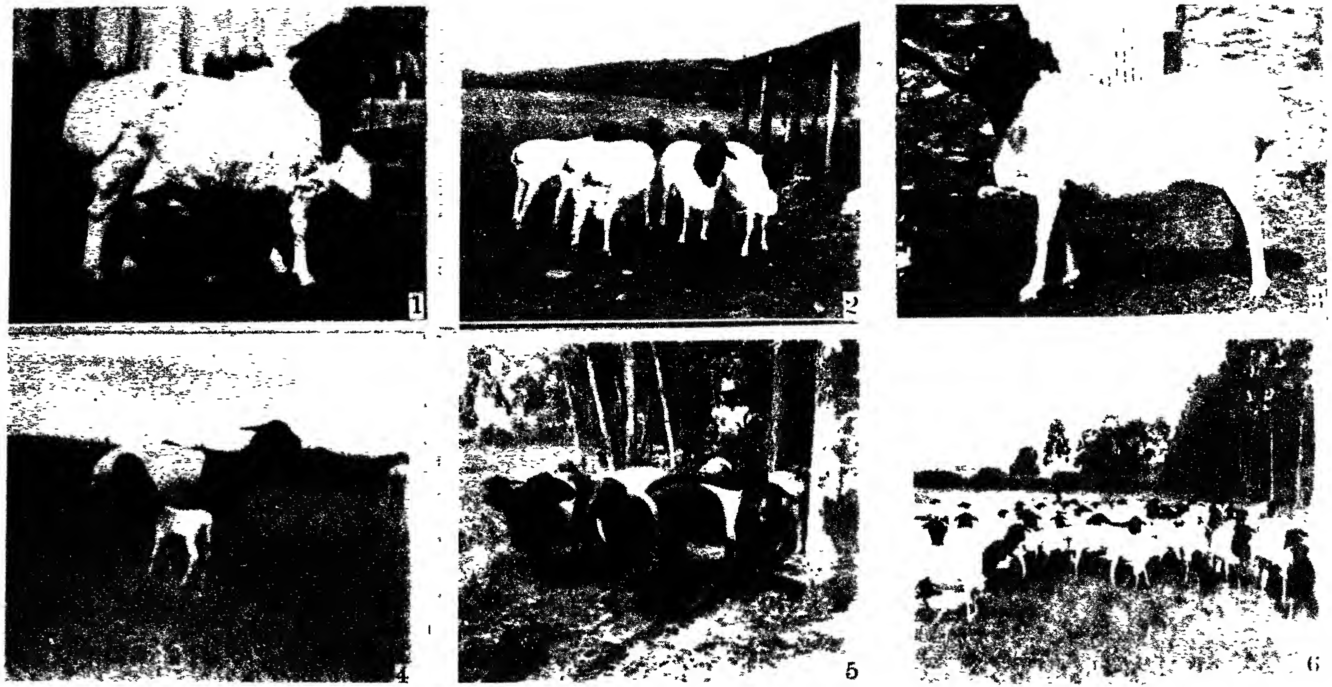
Suitable Breeds of Sheep.—Since much of the land in Southern Rhodesia is unsuitable for woolled sheep our choice of breed is very limited. Fortunately we have the Blackhead Persian breed, which is admirably suitable owing to its close grained skin, which is almost completely resistant to the piercing seeds. If well managed this breed gives quite satisfactory weights for age, is readily acceptable by the local butchers and the pelt has a high market value. This breed has several excellent qualities. It is a good forager, which enables it to do well on comparatively poor grazing, and it is practically immune to heart water and blue tongue. It should be remembered, however, that it is just as susceptible to internal parasites as any other breed.

Other breeds that can be bred where grass seed trouble is not serious and where the grazing is tamed or partly improved, are the Africander and the Karakul. Both of these breeds cross quite well with the common native stock. Up to the present neither of these breeds have, however, done as well as the Blackhead Persian and its crosses.

Characteristics of Good Breeding Sheep.—A ram must be pure-bred, possessing normal good size for age, having a strong constitution and a definite masculine character, with bold strong carriage, alert and active.

The ewe should possess a strong constitution. She should be robust, well developed and well proportioned. The better type of Kaffir sheep should not be despised as a foundation, for by using pure-bred rams and practising careful selection a good type of grade animal can be established in a few generations. If the flock is in the early stages of grading up using Blackhead Persian rams, colour in the ewes should not be considered of great importance.

Regulated Breeding.—To arrange this the rams should be with the breeding ewes for eight weeks only. In Matabeleland the most satisfactory time for the ewes to lamb is generally considered to be from the 15th March to the 15th



1. A good type of Blackhead Persian sire.
2. Young Blackhead Persian rams on a Rhodesian tarm.
3. A characteristic Blackhead Persian ewe.
4. Grading up
5 Crossbred Blackhead Persian x native lambs.
6. A Blackhead Persian flock on sheltered grazing.

May, thus the rams should be with the breeding ewes for the period of 15th October to the 15th December. In Mashonaland the months of April and May are the most suited, so the rams should be with the breeding flock during November and December. Maiden ewes should not be bred before they are full two tooth, and not then unless they are sufficiently well developed. The ewes should only be allowed to lamb once a year.

Management of the Flock.—Whether the flock be large or small, it must be managed properly if success is to be achieved.

Grazing of Flocks.—The ideal way to graze sheep is to allow them to graze in paddocks or camps without herding or kraaling. At the present stage of the flocks it is not practical to go in for an expensive vermin proof paddocking system. The alternative system is used by the majority of farmers, that is, to herd by day and kraal by night. Kraaling, however, is conducive to the spread of disease and therefore should be carefully supervised. Central kraaling should be avoided. It is a much better plan to provide a few kraals scattered well over the grazing area, so that the grazing of the various flocks may be changed frequently without excessive travel. When the sheep are let out of the kraals they should be kept moving steadily away to prevent them from grazing in the vicinity of the kraal. The grazing near the kraal is most probably heavily infected with the larvae of internal parasites, a condition brought about by the frequent concentration of the sheep in this area.

A few words on paddocks and camps is necessary for this system will come when the flocks grow to a large size. Paddocks or camps are a very decided assistance in the proper management of sheep. Provided these paddocks are properly managed sheep will do better in them than where they are herded. Under this system sheep get undisturbed grazing and rest. Moreover, paddocks properly managed encourage the development of the better grasses, prevent tramping out and lessen the chance of soil erosion.

There should be sufficient paddocks to make rotational grazing possible and to allow the grazing to be rested periodically. This rest is a most important point, not only from the standpoint of the pasture but also to assist in the

control of the internal parasites. Sheep should be dosed the day prior to their removal from one paddock to another, and should never be left in any paddock long enough for it to become "sheep sick." This condition can be recognised by the reluctance of the sheep to graze freely. All swampy areas should be fenced off if possible, as they are a serious danger to the health of the animals.

The size of paddocks or camps must be regulated by the number of sheep it is proposed to maintain. To estimate pasture requirements for sheep it may be considered that seven sheep require approximately the same grazing as would one mature head of cattle.

Management of Rams.—For service the ram should be healthy, not over fat, but in fair hard condition. For six weeks before putting the rams with the breeding flock they should be given some supplementary feeding, but not over fed.

Rams should not be allowed to run with the ewes day and night. Better results will be achieved if the rams are removed, if possible, for a few of the hottest hours each day and put into a shady paddock where they could be given a little supplementary feed. A good ration is one of six ounces of crushed or whole maize, or better still, half a pound of oats plus one pound of good bean hay. This extra feed will keep them active. However, it is not always possible to feed the rams separately when large flocks are run, and if in these circumstances the rams show signs of losing condition during the serving period, they should be removed from the breeding flock for a few days and fed daily one pound of grain. Oats are the best for this purpose. If, on the other hand, the rams are over fat and so disinclined to serve, any supplementary feed they are getting should be stopped. As a last resort they can be dosed with one ounce of Epsom salts every other day until they become less lazy.

It is only by using good rams and breeding at the proper season and age that size and stamina can be maintained in a flock.

During the non-breeding season the rams can be kept in a small well-fenced camp and fed on a maintenance ration. If only one ram is kept a few hamels can be kept in the camp with him for company.

Management of the Flock at Lambing Time.—Ewes heavy in lamb should be separated from the main flock and treated carefully. They must not be crowded or roughly handled. The better grazing should be reserved for them where they should be left as quiet and contented as possible.

Ewes that have been neglected and are in poor condition when they lamb will be unable to provide sufficient milk for the lambs, which are also likely to be born small and weak. This is often the case with late lambs. Under-fed weakling lambs very rarely develop into profitable animals.

It is possible to tell when a ewe is very near lambing by her restlessness, general uneasiness and large udder. An abnormal sinking in front of the hips will also be noticed. The ewe should be allowed to lamb in a shady paddock with a good water supply. During lambing time personal supervision must be increased. A careful inspection of the lambing flock should be made at least twice daily, for only in this way can the assistance, which is sometimes badly needed, be given at the time that it will be most effective.

If lambing has gone well the ewe will be found standing or grazing quietly near her lamb, which will usually be found lying down asleep. If a ewe has difficulty in lambing it may be necessary to give assistance. Before doing so the finger nails should be cut short and the hand and arm well covered with disinfectant soap. The normal presentation is one with the front legs and head first. If any other presentation occurs and causes difficulty, the lamb should be pushed back very gently and arranged in the correct position. If the ewe then cannot give birth to the lamb by herself, she can be assisted by gentle pulling. Where the lamb is obviously abnoral in size or is deformed and too large for the ewe to pass, it will be necessary to cut the lamb up and remove it in pieces. Habitually bad lambers should be marked and culled. Do not allow the ewe to lamb in a dark shed, because she may lose contact with the lamb for some hours. This neglect may prove fatal for the lamb.

Care and Treatment of the New-born Lambs.—In the case of weak lambs it is often necessary to catch a ewe, lay her on her side and then tempt the lamb to drink. A maiden ewe is sometimes disinclined to take her lamb, in which case she

should be caught and held while the lamb drinks. As a rule it will only be necessary to do this two or three times. Another method is to shut ewe and lamb in a small pen together and smear mucus from the lamb's mouth over the ewe's nostrils or a little of her milk over the lamb's rump and her own nostrils. If these measures fail then, as a last resort, a dog can be brought near. This will bring out the ewe's maternal instincts.

Apparently lifeless lambs may be revived by blowing into their nostrils and beating gently on the chest. When the breathing is normal they can be treated in the same way as a weak lamb. If a very young lamb should appear weak through lack of food, the ewe's udder should be examined. Sometimes the teats will be found sealed up, due to injury; if so, open up the teat channel with a sterilized needle.

When night kraaling is practised and the grazing is some distance from the kraal, the lambs should be left in the kraal during the day until they are about two weeks old. If the flocks are grazed on a paddock system draft the ewes to a fresh paddock when their lambs are strong enough.

Castration and Marking Lambs.—These operations are usually left too late, and it should be emphasised that the younger the lamb is the less the shock of the operation will affect the system.

Castration.—There are two common methods of performing this operation, the knife and the sheep Budizzo pincers. The former is to be preferred, but can only be used when blow fly is not prevalent. In performing the operation great care must be taken to have the hands and instruments well disinfected. The operation should be performed away from kraals or polluted ground. The tip of the scrotum should be cut off and the testicles grasped firmly with the teeth or thumb and fingers, the neck of the scrotum held firmly and the testicles gently drawn out. Bathe the wound well with a mild solution of permanganate of potash (colour pink). When sheep Burdizzo pincers are employed the lambs must be left until they are much older—two to three months. Care should be taken to hold the pincers closed for a least thirty seconds

and to nip each spermatic cord in two places. The lambs should be inspected at least three times during the three months following the operation in case the operation has not been completely successful.

Marking.—For easy identification it is a sound practice to make a distinctive mark in the ear of each sheep in the flock. Clippers that cut distinctive marks such as diamonds, triangles, circles, etc., can be purchased from most firms stocking agricultural equipment. Another way to mark sheep for identification is branding a distinctive mark, using marking fluid. Proper fluids are specially manufactured for branding sheep; only these should be used. Fluids of a tarry nature must never be used, as they ruin the portion of the skin that they come into contact with, for leather. Suitable marking irons can be made by bending thick wire to the desired letter or mark.

Weaning.—The correct age at which to wean the lamb will depend largely on the season and the feed the ewes have received. As a general rule five months is the most satisfactory age. Some good grazing should be reserved for the weaned lambs. A few hamels or dry ewes should be run with them for a short time after weaning to accustom them to their new conditions.

Weaned lambs should never be allowed to get a check or set-back for, if they do, they never properly recover.

Culling and Classing.—The lack of culling and selection in flocks in this country is one of the factors which is largely responsible for our poor type of sheep. Sheep are very prone to revert to their original type, and unless the undesirables are prevented from breeding the flock will not progress.

Culling must be done on very definite lines. The chief points to consider in culling mutton sheep are conformation, constitution, quality, size, faulty jaws, that is over or under-shot, and weak hocks. Bad breeders or unsatisfactory mothers should likewise be culled.

Classing and culling are carried out together. All animals before they go to the ram must pass through this operation, the culls removed: and in larger very high grade and pure-

bred flocks the remainder can be classed into two classes or groups for mating purposes. On these operations the commercial success of the flock largely depends.

When a flock is culled and classed for the first time it is usually only possible to remove the old sheep and definitely poor animals, later greater strictness can be adopted, so that flock will steadily improve.

Feeding Sheep.—*Wintering Sheep.*—On the mixed farm this should not be a difficult or expensive matter. A light daily ration for the main flock is two to three ounces of grain plus a little legume hay. An hour's grazing each day on either green forage or lucerne is a useful addition, and if the sheep are in fair condition such additions should be all that is required. Care should be taken when the sheep are first allowed into the field of green forage or lucerne to see that they do not over feed to commence with. They should be only allowed a few minutes per day, which can be gradually worked up to one hour or more. If this care is not taken bloating may result. The treatment for this condition is one teaspoonful of turpentine well mixed in six ounces of raw linseed oil. When giving this mixture the sheep must be handled gently. In severe cases it may be found necessary to puncture the animal on the left side near the hip with a trocha to relieve the pressure of gas. Remove sheep from green forage.

Reaped Maize and Legume Hay Lands.—The reaped maize land is a valuable source of winter feed, and it is a sound plan to allow the sheep to forage over these lands. They will pick up most of the fallen grains and also eat a good deal of the finer dried maize leaf, which has a quite good feeding value. Allow cattle to graze over these lands first so that they can pick up the majority of the lost cobs which, if the sheep get in quantity, may sometimes prove fatal to them. Even after this precaution start the sheep gradually on this new feed by allowing them to graze for only a few hours each day at first.

When reaping, all cobs showing diplodia must be collected and destroyed, as these are a danger to all livestock.

Old legume hay lands are safe to graze and are a most valuable source of feed.

Permanent Pastures.—The establishing of improved pastures for sheep has very great possibilities. There are many proved pasture grasses which can be grown and which are admirably suited for the purpose. Some of the more common ones are Woolly Finger grass, Rhodes grass, kikuyu grass, paspalum, Italian and perennial rye grass. By establishing paddocks of these grasses and thus overcoming the grass seed difficulty it will be possible to run better mutton breeds of sheep which are mostly woolled. Many of these breeds have been tried out in South Africa with success, such as the South Down, Dorset Horn, Ryland, Oxford Down, and to a lesser extent the Suffolk. Before permanent pastures can be used for this type of sheep a sufficiently large area must be established to enable rotational grazing.

Small areas of improved pasture are often a danger, owing to the great temptation to keep the sheep on them too long at one time. This must be very carefully guarded against, for if the paddock is continually used it will become heavily infected with internal parasites, thus the benefit which should be gained from the improved pasture will be lost.

Feeding Ewes and Lambs.—If possible breeding ewes should be given some feed to supplement the grazing during the winter months, and it will often be necessary to give supplementary feed from June. Do not completely stop feeding after weaning, but rather wait until there is an improvement in the grazing. This will assist the breeding ewes to regain strength and condition after mothering the lambs for five months. By keeping the ewes in fair condition they will take the rams sooner and a better lamb crop will follow.

Feeding Weaned Lambs.—Weaned lambs will benefit greatly if they are given some supplementary feeding, commencing at weaning and continuing until summer grass is available. For weaned lambs a suitable light ration to supplement grazing consists of two to three ounces of grain, half to three-quarters of a pounds of legume hay and some succulent feed daily.

Fattening Sheep.—A very large proportion of our annual mutton requirements is imported. This is due to lack of supply of the locally produced mutton. The imported animal

is not of very high quality, although on the average it is better than the type at present produced locally. Mutton and lamb are not very commonly used in this country owing to the inferior quality sold and the high price charged for it.

The consumption of mutton and lamb would be greatly increased if good quality meat was always available. There is thus ample scope for the development of the sheep industry with a prospect of profit for those who will look after their flocks properly.

Hamels should be sold before they have cut their first two incisors. Blackhead Persians and their grades should, if cared for properly, "dress out" between forty and fifty pounds at the age of twelve to fourteen months. Hamels should be fed a supplementary ration to finish them off for the market, but they should not be too fat.

The following is a suitable fattening ration to use where the grazing is not of much feeding value.

Concentrates... ...	Crushed maize or Kaffir corn or inyouti	$1\frac{1}{4}$ pounds.
Legume hay		$1\frac{1}{2}$ pounds.
Maize silage, pumpkins or majordas		2 pounds.

If legume hay is not available one quarter of a pound of ground nut cake or meat meal should be added to the other concentrates.

If the sheep are entirely pen fed they should be given as much fine hay as they will eat. Teff hay is suitable and should be fed in racks. A good supply of fresh drinking water should always be available. The hay and silage must given night and morning, and the legume hay put in the racks after the night feed.

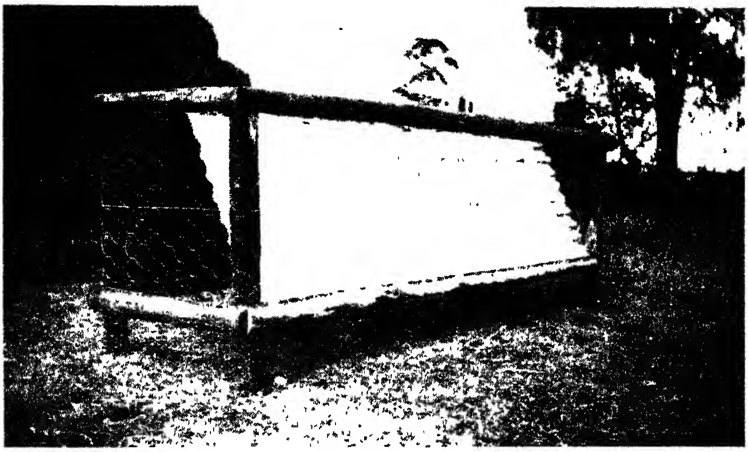
Fat Lambs.—By this is meant lambs to be marketed at three to four months old, dressing between twenty and thirty pounds. To reach this standard it is necessary to have a good stamp of ewe, which must be in good condition when she lambs. She must be fed carefully whilst the lamb is being grown, the idea being to feed the lamb through the ewe. It is most important that the lambs be kept growing rapidly without a check until they reach the weight desired.

3

A trough for feeding a mineral lick to sheep. Note the roof to protect the trough in the wet season.

A foot bath gives protection from foot rot.

A dosing race. This is a great convenience and lessens the labour in dosing as well as saving the sheep from being chased about.



A useful rack for feeding hay to sheep. The leaves and seeds do not get into the wool when the sheep feeds as is the case with the ordinary overhead rack.

The extra supplementary ration during winter months.

A modern layout for curing sheep skins.

A correctly cured sheep skin.

A well made up bale of sheep skins.

A good ration to feed ewes with lamb for fat lamb production is:—

Concentrates ...	Crushed maize, or Kaffir corn, or inyouti, 3 lbs.	Commence with ½lb. work up to 1½lbs. by end of 3rd week.
Bran or sunflower heads finely ground, 1lb.		
Legume hay		1 to 2 pounds.
Maize silage, pumpkins or majordas		2 pounds.

Free access to mineral lick (see licks). —

If legume hay is not available ¾ lb. of peanut cake or meat meal must be added to the concentrates, even if the grazing is sufficiently good to make it unnecessary to feed the ewes. It is a good plan to allow the lambs access to a grain mixture feed in a small separate enclosure or creep where the ewes cannot get to the rations of the lambs.

Marketing.—The fairest way to sell sheep is by live weight on the farm. Pure-bred Blackhead Persians and their grades in prime condition should dress out between 46 to 49 per cent.

When sending sheep to the market by road they should be driven slowly and in easy stages, so that they will lose as little condition as possible and present a good appearance on arrival. If the buyer is to visit the farm the sheep should be shown at their best—clean, and after drinking.

Licks.—A mineral lick is generally recommended for sheep in this Colony. Such a lick appears to be more essential in the heavier rainfall areas than in the dry sections. The following mixture has been adapted from one usually given in the Union of South Africa and should be generally suitable.

Bone meal	65 lbs.
Salt	32½ lbs.
Sulphate of Iron	2 lbs.
or Oxide or Iron	8 lbs.
Copper Sulphate	½ lb.
plus during spring and early summer —	
Flowers of Sulphur...	4 lbs.

Flowers of Sulphur is included to counteract possible prussic acid poisoning caused through eating wilted grass. If scrap tobacco is easily obtainable and at a reasonable price, such as one penny per pound, include about ten pounds of it coarsely broken in the above mixture. Sheep should not be given access to any lick during the day they are undergoing dosing for internal parasites, especially with Government wire worm remedy.

Management and Internal Parasite Control.—Flock management in this country is very largely regulated by the recommended methods of controlling internal parasite infection. These parasites are very prevalent in this country and, if proper control methods are not adopted they will eventually undermine the general health, constitution and size of the sheep, and be the cause of many deaths, especially in the young animals.

From a management point of view the following are the salient points to observe in internal parasite control.

1. Regular dosing of the sheep as recommended for the parasites concerned.

2. Wet moist pastures, vlei swamps and dams must be avoided; drinking water should be provided in proper drinking troughs.

3. Over stocking or keeping sheep in one paddock too long causes heavy infection of the pasture.

4. Supply a mineral lick as recommended. If the grazing is poor give some supplementary feed. Well nourished sheep are much less susceptible to internal parasite infection than weak ones.

5. Young stock are more susceptible to infection and should be separated from the main flock at weaning and not be returned until they are well developed.

6. If kraaling during the night is practised, drive the sheep steadily away from the kraal in the morning so that they cannot graze in the vicinity of the kraal.

How to determine the approximate Age of Sheep.—The usual method of telling the age of a sheep is by its teeth. This method is not exact but is quite satisfactory for practical purposes.

The temporary or lamb's teeth are small and are eventually replaced by permanent ones which are much larger. The animal's age is estimated by counting the number of pairs of the secondary incisors.

No. of Teeth.		Age of Sheep.
2 secondary incisors	two tooth ...	14 to 16 months.
4 ,, ,, ...	four tooth...	2 years.
6 ,, ,, ...	six tooth ...	3 years.
8 ,, ,, ...	full mouth	4 years.

After this stage age is determined firstly by the length of these incisors and later by the degree in which they are worn down, bringing into mind the type of grazing.

Preparation, Curing and Marketing of Sheep Skins.—In order to obtain the highest price skins must be properly flayed and cured. The sheep should be slaughtered in a clean place, preferably on a hard floor. The skin should then be removed in the orthodox way. Do not allow the skin to lie in dung or blood. After flaying the pelt should be washed to remove blood, etc., and any adhering fat scraped off with a blunt instrument. Care should be taken not to stretch the skin during this operation.

The skin should then be salted, a good salt—No. 2 grade is satisfactory—should be used and the skin should be allowed to cool off before applying the salt. If the skin has become too dry it should be soaked in water for a short time before salting. Too much salt cannot be used. The salt should be applied evenly all over, taking care that the edges get a proper application.

After salting the skin should be folded flesh side in and left for forty-eight hours. It should then be opened out and laid flat, flesh uppermost, on a screen of half inch wire netting and left in this condition to dry in the shade or, preferably, in a shed with plenty of air and light. See illustration. Drying in normal weather should take six to eight days.

Packing.—Leathery sheep pelts are packed flat, woolled pelts folded double. The bales should be approximately one hundred pounds in weight. Place the two poorest pelts on the outside so that there will be less loss if damaged. Tie bundles as illustrated, using only rope. Do not paint your name and address on the skin, because tar or paint will ruin that portion of the pelt for leather. The correct method is to stencil your name and the address to which the pelts are to go on a piece of hessian, which is then placed over the top pelt before tying. The rope will hold it in place.

Dispose of the pelts quickly. Do not allow them to remain on the farm for months and so expose them to insects. If it is necessary to keep the pelts on the farm for a considerable time spray them with the following solution:—

Arsenite of soda	1 lb.
Water	100 gallons.

Agricultural Experimental Station, Salisbury

ANNUAL REPORT, SEASON 1934-35.

By H. C. Arnold, Manager.

The total rainfall for the season October, 1934, to April, 1935, was 31.07 inches. Although this amount is about equal to the precipitation of the previous season, its incidence was less favourable for crop production, and much lower yields were recorded for nearly all of the crops. The first copious shower fell on November 13th, and between that date and January 15th a total of 20.50 inches was reached. Hence about two-thirds of the total precipitation occurred within that period of roughly two months. The excessive rains, lack of sunshine and low temperatures combined, retarded the growth of the majority of the crops, and although warmer weather eventually arrived, it came too late to effect their recovery, with the result that the yields were the lowest recorded for several years.

Analysis of Rainfall.

Month.	No. of rain days.	Total for the month.	No. of rains over ¼ inch.	Total to end of month.	Periods exceeding one week without rain.
October . .	3	1.89	3	1.89	Oct. 24th to Nov. 4th.
November	12	4.53	7	6.42	
December	20	7.66	10	14.08	
January .	17	9.60	12	23.68	Jan. 25th to Feb. 1st.
February	10	4.33	3	28.01	Feb. 23rd to Mar. 12th.
March. . .	10	2.98	5	30.99	
April . .	3	.08	—	31.07	Apr. 7th to Apr. 24th.
	75	31.07	40		

Although the number of days on which rain was recorded is not much above the average for recent years, the total of 40 days on which the precipitation exceeded a quarter of an inch is the highest recorded since the exceedingly wet season of 1924-25; the average for the period 1926-34 being 32 days.

The results of experiments conducted at this station since 1919-20 are available for reference in bulletin form, and to facilitate comparison this report is drawn up on similar lines to previous ones.

Having served their purpose the following experiments were discontinued:—

(1) Investigation of the effect of ploughing under undecomposed maize trash on the yields of (*a*) maize, (*b*) ground nuts.

(2) Comparison of the effect on the maize crop which follows ploughing under (*a*) sunnhemp, (*b*) sunflower, (*c*) a mixed crop of sunnhemp and sunflower.

A number of new experiments were commenced which included the following:—

(1) Comparison of the effect on the yields of maize of various quantities of raw rock phosphate, namely, (*a*) 150 lbs. per acre, (*b*) 300 lbs. per acre, (*c*) 450 lbs. per acre. The fertiliser will be applied to each of the maize crops, and the land will be green-manured every third season.

(2) Comparison of the effect on the yield of ground nuts of earthing at various stages of growth.

(3) Investigation of the influence on the yield of ground nuts, of the number of kernels in the parent pods.

(4) Comparison of the effects on the yield of maize following green manure, when the land is ploughed a second time in addition to the ploughing given at the time the material is ploughed under.

CROP ROTATION EXPERIMENTS.

FIRST SERIES 1913-1935.

Maize Yields in Bags per Acre.

System of Cropping.	1934-35. Rainfall 31.07 in.	1933-34. Rainfall 31.54 in.	1932-33. Rainfall 27.64 in.	1931-32. Rainfall 26.62 in.	1930-31. Rainfall 31 47 in.	1929-30. Rainfall 23.46 in.	1928-29. Rainfall 31.62 in.	Average yields.
*A1—Maize continuous. Green manure and 250 lbs. per acre of phosphatic fertiliser in the seasons 1928-29 and 1932-33 ...	4.99	19.04	Green manure ploughed under	9.60	12.60	15.88	Green manure ploughed under	12.42 (5 crops)
*A2—Maize continuous. Fertiliser only, rates as above ...	2.01	8.74	3.53	10.92	2.99	11.44	6.20	6.55 (7 crops)
†B—Alternate maize and beans for hay; no manure or fertiliser	4.45	6.60	2.34	10.02	1.95	6.43	5.65	9.21
C—Three-course rotation: Maize, velvet beans (reaped), oats; no manure or fertiliser	5.82	10.75	4.90	11.1	11.70	11.36	12.00	13 45
D—Four-course rotation:— Maize (plus 6 tons dung per acre), oats, bean hay, maize. Average of two plots...	6.81	14.70	14.21	16.33	14.93	15.79	19.00	
Maize (no manure direct)	6.80	11.90	14.40	14.80	14.95	13.25	21.35	16.97 (18 years)
Maize (dunged plots)	6.2	17.50	14.02	17.85	14.90	18.33	16.55	17.56

***Note.**—Having grown maize for 15 years in succession without manure or fertiliser, during which time its yields had gradually decreased until they had become so low as under practical field conditions to have rendered them negligible, this plot had served its purpose. With the object of comparing two methods of again raising the cropping power of such land to a more profitable standard, the whole plot was treated with a mixture of one-third bone meal and two-thirds superphosphate at the rate of 250 lbs. per acre at the beginning of 1928-29 season. One-half of the plot was then planted to maize while the other half was sown to a mixture of sunnhemp and velvet beans, which were subsequently ploughed in. This manurial treatment was repeated on the respective plots during the season 1932-33.

†In 1929-30 this system was amended from "Alternate Maize and Bare Summer Fallow" to "Alternate Maize and Beans for Hay."

System A.—The maize yields obtained in this section again reveal in a striking manner the beneficial effects of green-manuring. On both the A1 and A2 plots the same amount of fertiliser has been applied since the season 1928-29, but the plot which has been green-manured has given an average yield

of 12.42 bags per acre (5 crops), whilst that which has not been green-manured has yielded an average of only 6.55 bags per acre (7 crops).

System B.—This system furnishes striking evidence of the beneficial effect which a leguminous crop may exert on the maize crop which follows it. During the seasons 1929-33 dolichos beans for hay alternated with the maize crops, but in most seasons insect or other disease seriously reduced the legume crop, so that commencing last season it was decided to use a mixture of velvet and soya beans for the hay crop and a considerably heavier crop than those of the previous years was obtained. That the heavy hay crop likewise left a larger residue of organic matter in the soil than its predecessors is indicated by the maize yield this season, which is more than twice as large as the average crops taken from this plot in the years 1933 and 1931. This increased yield is the more remarkable because it has occurred during a season in which the unfavourable climatic conditions are reflected in very considerably reduced yields from nearly all of the other plots.

System C.—When it is remembered that this land has been cropped every year for some 22 years and that no manure or fertiliser has been applied it is not surprising that its yields of maize are decreasing and are now becoming subject to wide fluctuations due to seasonal conditions.

System D.—Contrary to previous experience gained from these plots the effect of the unfavourable climatic conditions has been very severe this season and is shown by the lowest yields ever recorded in this series. The plot which received farmyard manure has yielded no more than could have been expected had the manurial treatment been omitted. The reason for this is probably due to the excess of moisture and lack of air in the soil accompanied by low temperatures which combined to prevent the normal development and action of the soil micro-organisms which are so largely responsible for the conversion of manure into plant food after it is applied to the soil.

Rotational System H. Maize after green-manure ploughed under plus 200 lbs. per acre superphosphate. Compare with maize which received farmyard manure in System F and note the healthier growth on this plot.

Rotational System F. Maize plus farmyard manure. The manurial treatment had very little effect on the yield of maize.

SECOND SERIES OF CROP ROTATIONS.

These rotations were laid down in 1919-20 and were designed to evolve a system of cropping which would meet the needs of farmers who could not adopt mixed farming. The series included two plots, A. and F., on which maize was grown continuously for ten years without manure or fertiliser to serve as checks on the results from the rotations. For this purpose the cropping of Plot A. continues as in the past, but on Plot F., commencing season 1929-30, fertiliser is applied in alternate years. The fertiliser treatment given to this plot is the same in quantity and quality as that accorded in rotational System H., but green-manuring is entirely omitted.

Plot A: System E.—Maize continuous without manure or fertiliser:

Seasons and Yields of Maize in Bags per Acre.

1934-35.	1933-34.	1932-33.	1931-32.	1930-31.	1929-30.	Average over 16 years.
2.21	4.60	1.74	11.60	2.33	7.85	9.79

The yields from this plot are now so low as to be quite uneconomic. In favourable seasons fairly good yields may be obtained, but are not large enough to compensate for the predominating low yields.

Plots B to E: System F.—Three-quarters of the land under maize, one-quarter under Sudan grass. Each year one section under maize, commencing with Plot B in 1919-20, receives eight tons of farm manure per acre, and commencing on Plot E in 1929-30, the section which grew Sudan grass the previous season receives 200 lbs. per acre of superphosphate (19 per cent. P_2O_5).

Maize Yields in Bags per Acre.

	1934-35.	1933-34.	1932-33.	1931-32.	1930-31.	1919-20.	Average 1920-35.
Plot B	7.19†	Sudan	9.72	22.65*	9.10†	26.0	16.97
Plot C	Sudan	15.45	10.75*	19.33†	Sudan g.	23.7	15.33
Plot D	6.05	18.80*	11.05†	Sudan g.	9.10	Sudan g.	15.76
Plot E	6.99*	17.73†	Sudan g.	19.23	13.42*	24.6	15.93
Average	6.74	17.33	10.51	20.41	10.54	24.7	15.99

*Indicates the application of fa-myard manure.

†Indicates the application of 2[illegible] lbs. per acre superphosphate.

The baneful effect of continuously cropping the land with cereals is shown by the low yields recorded on these plots this season. They are the lowest ever recorded in this system, and even the plot which received farmyard manure failed to make appreciable response to the treatment, and in this respect it corroborated the results observed in System D.

Plot F: System G.—Maize continuous. No manure or fertiliser during the first ten years. Commencing season 1929-30, fertiliser consisting of one-third bone meal and two-thirds superphosphate at the rate of 200 lbs. per acre is applied every alternate year.

Seasons and Yields of Maize in Bags per Acre.

1934-35.	1933-34.	1932-33.	1931-32.	1930-31.	1919-20.	Average over 16 years.
3.70	14.55*	5.33	21.08*	7.03	23.3	11.32

*Indicates the application of 200 lbs. per acre fertiliser.

During the past few seasons the applications of fertiliser have synchronised with favourable climatic conditions, resulting in the alternation of very high and very low yields. The yield this season may be compared with that of Plot D. in System F., and it will be seen that in the latter system nearly twice as much maize was obtained, due apparently to the residual effect of the previous season's dressing of farmyard manure. Although the yields in System F are low, they are nearly double the amount recorded in this system, illustrating the beneficial effects which follow the addition of humus to the soil, and that it acts as a stabiliser of soil fertility, enabling the soil to produce heavier crops during unfavourable seasons.

Plots G to K: System H.—Three-quarters of the land under maize, one-quarter under velvet beans, which are ploughed under for green manure. From the commencement of this experiment until 1928-29 this land received one green manuring and one application of fertiliser during each period of four years. The returns from these plots showed that insufficient plant food had been supplied to maintain fertility, and the manurial system was then amended to provide for two dressings of fertiliser during each four-year period. The crop

of maize which follows the green manuring now receives 200 lbs. of 19 per cent. superphosphate per acre, which should enable it to make better use of the nitrogen supplied by the green manure; the second maize crop receives no fertiliser, and the third crop, that immediately in front of the green crop, receives 200 lbs. per acre of a mixture of bone meal and superphosphate.

Maize Yields in Bags per Acre.

	1934-35.	1933-34.	1932-33.	1931-32.	1930-31.	1919-20.	Average 1920-35.
Plot G	14.58*	Beans	5.94*	12.75	16.80*	23.10*	14.77
Plot H	Beans	14.50*	9.32	22.45*	Beans	23.00	15.53
Plot J	4.34*	12.25	10.65*	Beans	6.10*	Beans	13.57
Plot K	3.59	19.65*	Beans	16.50*	7.53	19.20	14.20
Average	7.50	15.47	8.63	17.23	10.14	21.70	14.52

*Denotes application of fertiliser.

The most striking feature of the results for the season under review is the heavy yield from Plot G, where the maize followed velvet beans ploughed under for green manure. The returns from this plot during the past three seasons indicate that, in spite of the dressing of fertiliser applied in the season 1932-33, the lack of humus in the soil at that time limited the yield to less than 6 bags of maize per acre. The humus was provided in the following season by ploughing under a velvet bean crop, and a further application of phosphate combined with the residue from the previous dresssing restored fertility of the soil to such an extent that during the present season a heavy crop resulted in spite of the unfavourable climatic conditions. These results are the more remarkable because applications of humus in the form of farmyard manure in Systems D and F had very little effect on the yield. The low yield obtained on Plot J provides further evidence of the futility of applications of phosphatic fertiliser to land which is deficient in humus. Although such applications may appear to be justified by results when the season is a favourable one, they are definitely uneconomic when the climatic conditions are not suited to the requirements of the crop.

NEW ROTATIONAL SYSTEMS.

Earlier experiments having shown the beneficial effects which follow the inclusion of different kinds of crops in the rotation, in addition to applications of phosphatic fertilisers and the maintenance of the humus content of the soil, two new rotational systems in which these principles are combined, were commenced in the season 1926-27. These have been designated Systems M and O respectively. In the former system, from the commencement of the trials until the season 1933-34, the land was green-manured and fertilised once during each period of four years and was cropped to maize twice, and either ground nuts or sunflowers once, during that period. Dwindling yields indicated that the manurial treatment was not sufficient to meet the needs of the crops, and commencing in the season 1934-35 a second dressing of fertiliser was added. In the second system the humus is supplied by 8 tons per acre of farmyard manure every fourth year, and this is supplemented by a dressing of 200 lbs. per acre of bone and superphosphate in the second season after the manurial application. Maize is sown on the land which is manured or fertilised, and sweet potatoes and hay crops are grown in the intervening seasons. System M is suitable for farmers whose supply of farmyard manure is limited, and those who wish to dispose of their crops off the farm, while System O is suited to owners of livestock, to which the crops can be fed, though it provides for the alternative course of marketing a large part of the crop direct should it be found more convenient or remunerative to do so.

System M.—This is a four-course rotation in which the sequence of the crops is:—Maize+200 lbs. per acre of superphosphate; ground nuts and sunflowers; maize+200 lbs. per acre of bone and superphosphate; green-manure. Hence one-half of the land is sown to maize, one-eighth to sunflowers and another eighth to ground nuts, and one-quarter is green-manured. In the following tabulation the yields of the various plots are expressed in bags per acre, a "bag" of maize being 200 lbs., and a "bag" of ground nuts 75 lbs.

Seasons and Yields of Maize in Bags per Acre.

	1934-35.	1933-34.	1932-33.	1931-32.	1930-31.	1926-27.	Average maize yield. 1926-35.
Plot A	G.M.	13.75*	N14.00	17.20	G.M.	G.M.	12.68
Plot B	5.55*	N14.30	10.15	G.M.	6.25*	15.15*	10.92
Plot C	N8.8	12.60	G.M.	15.05*	N6.00	N21..0	13.66
Plot D	7.95*	G.M.	8.05*	N11.0	13.38	12.6	11 12
Average maize yield	6.75	13.17	9.10	16.13	9.82	13.88	12.10

*Denotes the application of fertiliser.

G.M. Denotes the application of green manure.

N. Denotes the position of the ground nuts in the rotation.

During the period 1930-33 the average maize yield in this system was nearly equal to that of System H where twice as much fertiliser was being used, but since that time the yield in this system has dropped somewhat below that of the other system.

The introduction of a second dressing of 200 lbs. per acre of superphosphate which was commenced this season will equalise the manurial treatments of System M and H and establish a sounder basis for comparison between them. Future results will reveal whether there is any advantage to be gained from the mixed cropping system in contrast with the practice of growing maize continuously with the green manure crop as the only variation.

System O.—In this system the humus content of the land is maintained by the application of 8 tons per acre of farmyard manure, and 200 lbs. per acre of bone and superphosphate during every period of four years. The order of rotation is:—Maize fertilised; sweet potatoes; maize with kraal manure; hay crops. This system is typical of a rotation suitable for dairymen or others who can make use of their crops by feeding them to stock. In practice it might be found more profitable to leave the sweet potatoes down for two years, and in that way secure a volunteer crop at a low cost. This might involve some alteration in the plan of the rotation. Further, many farmers will prefer to grow pumpkins and majordas as well as

sweet potatoes to fill their requirements for succulent feed. Similarly, alterations would probably be made with the other crops, to suit the individual farmer's conditions, but if the principles are adhered to, the results may be expected to be approximately the same.

In the tabulation below are shown the acre-yields of maize in bags of 200 lbs. and of bean hay and sweet potatoes in tons.

Seasons and Yields in Bags (or Tons) per Acre.

	1934-35.	1933-34.	1932-33.	1931-32.	1930-31.	1926-27.	Average maize yield. 1926-35.
Plot F	H3.8	19.18†	P3.6	18.55*	H1.5	H1.1	17.46
Plot G	11.58†	P5.5	9.10*	H1.2	16.78†	19.65	15.08
Plot H	P5.65	20.80*	H0.56	20.25†	P7.4	P6.1	18.35
Plot J	9.84*	H2.5	9.95*	P12.40	14.03*	16.45*	15.40
	——	——	——	——	——	——	——
Average of maize plots	10.71	19.99	9.53	19.40	15.41	18.05	16.57

*Denotes the application of fertiliser.
†Denotes the application of farmyard manure.
P. Denotes the position of the sweet potatoes in the rotation.
H. Denotes the position of the bean hay crop.

In this system the same amounts of farmyard manure and fertiliser are used as in System F, but a wider range of crops are employed. In the five year period 1931-35 the average acre yield of maize in System F was 13.11 bags per acre, but in System O it was 15.01 bags per acre. The yield of the sweet potatoes has averaged 6.2 tons per acre and their value as stock feed may be taken as equal to 15 bags of maize. Further, the sweet potato and the legume hay have a higher feeding value than the Sudan grass provided by System F. It appears therefore that the feeder of livestock would find a rotational system similar to System O, which would provide the material for balancing the rations of his cattle as well as a balanced system of cropping, to be more profitable than one which consists almost entirely of maize or other cereals.

METHOD OF APPLICATION OF FERTILISER TRIALS.

Method of Application of Fertiliser Trials.—These investigations were undertaken at the request of the Maize Association with the object of ascertaining whether the manner in which

fertiliser is applied to the land is likely to affect the yield of the maize crop. Fertiliser is applied in four different ways, namely:—

(1) Broadcast shortly before planting time and harrowed in.

(2) Broadcast during winter and ploughed in.

(3) In holes in check rows shortly before the seed is planted.

(4) In drills at the time of sowing the seed.

Previous trials, conducted over a period of several years, have shown that, with the exception of method No. 1, the various methods of applying the fertiliser were equally efficacious. That the fertiliser should prove less effective when it is broadcast over the land and harrowed in shortly before the planting time is regarded as particularly unfortunate, because this method is the most convenient and is the one employed by the majority of our farmers. Other experiments have shown that applied phosphates which are not absorbed by a crop during the first season may be utilised by a later crop, and it is reasonable to suppose that the unabsorbed part of the fertiliser broadcast on the surface and harrowed in may be recovered by subsequent crops. The plan of this experiment was therefore re-arranged in the season 1931-32 to permit of each method of applying the fertiliser being practised on its own particular group of plots for so long as is necessary to ascertain whether that part of the fertiliser which is not used during the season of application may not be utilised by the crops which follow in subsequent years. In these trials each method of applying the fertiliser is replicated five times, superphosphate being used at the rate of 150 lbs. per acre over the whole series of plots. During the season 1933-34 the land devoted to these trials was green-manured, and it is proposed to continue this practice at intervals of three years.

The following table records the yields of maize in lbs. per 1-20th acre plot. In the first column under each heading are the combined yields for the seasons 1931-32 and 1932-33, while the second column shows the yield for the season under review.

METHOD OF APPLYING FERTILISER.

Yields of Maize in lbs. per Plot of 1-20th of an Acre.

Harrowed in.		Ploughed in.		Holes.		Drills.	
1931-33.	1934-35.	1931-33.	1934-35.	1931-33.	1934-35	1931-33.	1934-35.
246	133	318	116	263	103	300	131
231	87	312	108	277	110	244	123
230	114	293	116	191	113	337	149
166	95	239	111	250	120	221	112
251	97	224	103	254	119	216	91
1,124	526	1,386	554	1,235	565	1,318	606

Although the difference between the yields resulting from the respective methods of applying fertiliser is not so large this season as it was in the previous two seasons, these results still indicate that smaller yields are obtained when the fertiliser is applied to the surface of the land and is covered no deeper than is possible with the ordinary drag harrows than when either of the other methods is employed. The reason for this year's results being more favourable toward the surface application than those of previous years may have been due in part to the influence of the green manure crop on the residue of the fertiliser applied to the previous crops, but it is thought that the chief reason may be ascribed to the excessively wet condition of the land during the early part of the growing season. Such a condition would favour the development of the root system among the fertilised surface layers of the soil, and hence this season's results are somewhat less markedly in favour of those methods by which the fertiliser becomes mixed with the subsurface layers of the rooting medium.

The Relative Value of Sunnhemp and Sunflower for Green Manure.—The results of earlier trials which have already been reported have indicated that somewhat heavier crops of maize were produced where the land was green-manured with sunnhemp than where a pure stand of sunflower was ploughed under. When a mixture of equal proportions of both of these crops was employed the resulting maize yield was intermediate between those following the pure stands of green manure.

Soya Bean variety trials.
Background—Left: Bilton. Right: Otoxi. Foreground—Left: Herman.
Right: A white seeded non-shatter variety.

Frequency of green-manuring trials.
Left: First crop after green-manure. Right: Third crop after green-manure.
Both crops received 150 lbs. per acre of superphosphate.

Lawn grass test plots.

With the object of repeating these trials sowings of the two green manure crops and the mixture were made early in the season, before the commencement of the regular rains. Germination was satisfactory, but when the plants had reached a few inches high the sunnhemp was attacked by a heavy infestation of small black and brown Malacosoma beetles, which were so numerous and voracious that they entirely destroyed the crop. The sunflowers were not attacked, and in consequence the plots which were sown to that crop produced a satisfactory growth for green manure. The infestation of Malacosoma beetles was unusually severe during the season under review, but this occurrence has demonstrated the advisability of sowing a mixed crop of sunflowers and sunnhemp, because owing to their dissimilarity each is to a large extent immune to the diseases and insect pests of the other. Hence if one crop fails the other will take its place and produce a useful crop for ploughing under in spite of the mishap to its former partner.

Comparison of the Effect of Annual Applications of Small Quantities of Farmyard Manure with that of Larger Quantities at longer Intervals.—On the majority of the farms in this Colony the supply of farmyard manure is very limited, and the question has arisen as to whether its beneficial effect will be greater if it is spread thinly over a large area each season or whether it will be equally potent when it is applied in heavier dressings at less frequent intervals.

In order to investigate this point experiments were commenced in the season 1931-32 in the manner shown below when all of the plots received their appropriate dressings.

(1) Three tons per acre of farmyard manure every year.

(2) Six tons per acre of farmyard manure every second year.

(3) Twelve tons per acre of farmyard manure every fourth year.

This plan provides for the application of an uniform dressing of twelve tons of manure per acre over the whole series of plots during each period of four years. The land is cropped to maize each year.

In the following tabulation the yields obtained on the various plots during each period of two years are given.

Yields of Maize in lbs. per Plot of 1-15th Acre.

	Three tons every year. 1931-33.	1933-35.	Six tons every second year. 1931-33	1933-35.	Twelve tons every fourth year. 1931-33.	1933-35.
	527	397	471	378	512	354
	479	355	471	340	507	323
	450	331	431	319	520	324
	441	299	436	278	460	249
	398	255	424	265	476	272
	2,295	1,637	2,233	1,580	2,475	1,522
Totals	3,932		3,813		3,997	

In comparing the totals for the four-year period it is seen that the weights of maize produced are practically the same in each case, the differences observed being due to fortuitous factors and not to the method of applying the manure. The small differences between the yields resulting from the various treatments during the first two years is perhaps surprising, for it is shown that the six-ton dressings were almost as effective as the applications of double that amount. This suggests that farmers who cultivate large acreages and have only a limited quantity of manure would make the most economical use of it by distributing it in comparatively light dressings, but the results also indicate that when heavier dressings are applied they will continue to exert a beneficial effect over a number of years, and that the valuable properties contained in the manure will not be lost through leaching or other causes.

It is not possible to lay down a definite rule which will be applicable in every farmer's case, but in comparing the merits of the various methods it must be remembered that although by spreading the available manure over a wide area larger immediate returns may be obtained; this practice will also entail a somewhat larger expenditure on haulage and distribution.

Pyrethrum.—The demand for new crops to take the place of maize and others whose production has exceeded market requirements during recent years has stimulated interest in

pyrethrum, which crop is the chief source of the material used in the manufacture of certain insect powders, liquid insecticides, etc. The fact of its being successfully cultivated in parts of Kenya Colony suggests that its production in this Colony might also be found to give profitable returns.

Investigations were commenced here in the season 1931-32, when seed obtained through the courtesy of the Director of the Pathological Laboratory of the British Ministry of Agriculture was sown in nursery beds with a view to the raising of a stock of plants for transference to the open ground at the commencement of the rainy season. A part of this stock was planted on land which could be irrigated and the remainder was planted in the open ground where no artificial irrigation could be practised.

Irrigated Pyrethrum.—The first main crop from these plants was reaped during October and November, 1932, when a yield of 55 lbs. per acre of dried flowers was obtained. In the following season the yield increased to 230 lbs. per acre, but after that season the plants declined in vigour, several dying completely, and the yield decreased to 112 lbs. per acre in the year 1934. There was a further drop to 58 lbs. per acre during the season under review. The stand has been still further reduced by the death of a number of plants, so that only 55 per cent. of the original stand now remains.

Dryland Pyrethrum.—In order to assist the plants to withstand the effect of the long winter drought and allow of the use of a five-tine cultivator between the rows, the plants in this plot were spaced 36 inches x 18 inches apart, which is twice as far between the rows as those under irrigation. These plants have not received artificial irrgation at any time, but during August, 1932, exceptionally heavy rains, totalling two inches, were recorded, and these seemed to assist the plants very considerably by sustaining them through the prolonged drought which is usually complete between that time and the end of October, when the regular rains may be expected. The main crop of flowers were produced during the month of

January, 1934, and the total weight of dried flowers was 80 lbs. per acre. The following season the winter drought was not relieved by effective rains, and the crop appears to have suffered in consequence, because the yield decreased to 12 lbs. per acre in 1934. Similar low yields have been recorded each season since, and a large proportion of the plants have died. For these reasons it can only be concluded that this first attempt to cultivate pyrethrum under dryland conditions has not given results which are sufficiently encouraging to justify its cultivation on a commercial scale.

Since the commencement of these experiments further plots have been laid down on the dryland section each year, but with the exception of a few isolated plants the amount of flowers produced has been much below that required to make the crop one of economic value.

Among the individual plants comprising the stand a few have produced exceptionally abundant crops of flowers, the seed of these has been allowed to mature for the purpose of segregating strains for further investigation into the possibility of establishing strains which can be profitably cultivated under the condition peculiar to this Colony.

Wintersome Fodder.—This plant has been included in our Sorghum variety trials during the past two seasons. It possesses many of the characteristics of the saccharine sorghums, and would appear to be a robust form of that group of plants. The growth of the seedlings was found to be very slow at first, making the weeding of the crop somewhat irksome, but after the first month growth became much more rapid and the stand reached to over ten feet high at the time of flowering. The plants stooled well, each producing four to six stalks, and these contained the sugary juice which is characteristic of the saccharine sorghums. Stalk borers reduced the production of seed somewhat, but the average for the two seasons was 1,115 lbs. per acre. Only 5 lbs. of seed or less is required to sow an acre, so the crop is a very economical one in this respect. The following tabulation shows the average yields of triplicate plots in the sorghum variety trials.

Yields of Green Fodder in Tons per Acre.

Date of reaping.	Winter-some.	Amber Cane.	Irungu Sorghum.	Native Sudan.	White Kaffir Corn.
12.3.1934	25	16	—	14	—
22.3.1935	15	7	7	10	8

These results show that Wintersome produces very heavy crops of fodder, and particularly so when it is grown under favourable conditions. In order to obtain the best results, early sowing appears to be necessary; stalk borers and other insects pests attack the late sown crops, and in certain seasons reduce the yield very considerably. In the season 1933-34 the Wintersome which was sown during January yielded approximately 10 tons of green fodder per acre, but that sown on January 4th, 1935, almost completely failed. This may have been largely due to the excessively heavy rains which occurred during that month and part of February, for it is well known that the sorghums prefer comparatively dry climatic conditions. By the courtesy of the Chief Chemist samples of the green fodder of Wintersome, velvet bean and maize which had been grown under identical conditions and were ready for ensiling were analysed and found to contain the constituents given in the following table calculated on a moisture-free basis.

	Ash.	Crude Protein.	Ether Extract.	Fibre.	Carbo-hydrates.
Wintersome ...	5.10	4.70	0.93	29.70	59.57
Maize	4.75	3.90	1.39	21.18	68.78
Velvet bean... ...	7.44	15.06	1.72	28.94	46.84

These analyses indicate that the Wintersome fodder is similar to maize fodder and has about the same food value. Both are comparatively low in protein and are surpassed by the velvet bean fodder which contains three times as much protein as either of the others. Wintersome was found to be very suitable for conversion into silage. The finished product had a pleasant molasses-like odour, and it was readily eaten by cattle. Velvet beans ensiled alone proved somewhat unpalatable, but the addition of Wintersome fodder at the time the silage was made improved the palatability sufficiently for it to be readily taken by all of the cattle to which it was fed.

Annual Report of the Division of Irrigation

FOR THE YEAR ENDING 31st DECEMBER, 1935.

By C. L. Robertson, B.Sc., A.M.I.C.E., Chief Engineer, Irrigation Division.

In previous years the marked increased demand on the services of the Division have been consistently recorded, but in the year under review the increase in both the scope and volume of the work performed has been abnormal as reflected in the figures given later of the expenditure controlled and administered by this Division and the number of visits paid by the various officials.

This abnormal increase has been due to the following factors:—

(*a*) The adoption by the Government of a policy for the construction of major irrigation works and the provision of increased funds to speed up the construction of water conservation works in Native areas.

(*b*) The provision by the Government of funds for the construction of storage works and water supply installations to serve small townships such as Gwanda and Plumtree.

(*c*) The provision of irrigation loan funds on easy terms which has resulted in a large increase in the number of water conservation and irrigation works constructed on privately-owned farms.

(*d*) The realisation by farmers of the necessity for the construction of soil conservation works due to propaganda conducted by the Soil Conservation Councils and the local sub-committees appointed in the previous year.

The technical staff of the Division was only increased by the appointment of one engineer and one draughtsman during the year and by the part-time employment of three farmers as local technical advisers for setting out soil conservation works in their areas.

The demand has only been met by the members of the staff working at undue pressure which cannot be maintained if efficient work is to be performed, and it is hoped that the situation will be relieved next year by the appointment of the additional staff requested.

The following summary sets out the approximate expenditure controlled and administered by the Division during 1935 together with the estimated costs of water supplies for Government institutions investigated during the year but not installed. This does not, however, include any estimate in connection with works constructed by farmers, except if irrigation loans have been applied for, on advice given by this Department.

Summary of Expenditure Controlled and Administered, Etc.

General boring operations		£7,810
Water supplies in Native Reserves—		
(*a*) Boring	£7,300	
(*b*) Water conservation works	6,090	
	———	13,390
Water supplies in Native Purchase Areas—		
(*a*) Boring	1,230	
(*b*) Water conservation works	1,050	
	———	2,280
Water supplies: Government Institutions ...		5,170
Water supplies: Townships		1,835
Irrigation Loan Funds: Loans granted ...		3,455
Soil conservation investigations		315
Agricultural buildings erected		1,360
Construction: Government water conservation works		2,840
Meteorology and Hydrography		1,175
Total		£39,630

Estimated costs of water supplies, Government Institutions surveyed and reported on but not constructed	£6,500

General.—The summary below sets out the number of visits paid by officers of the Division in connection with irrigation, water and soil conservation, water supplies, etc., but no provision is made for visits performed in this connection by either the Boring Superintendent or Boring Inspector, although these two officials have aided considerably in this respect.

Summary of Visits.

(1) Visits to private applicants on irrigation and water conservation	251
(2) Visits to private applicants on soil conservation ...	181
(3) Visits in connection with water conservation works: Native areas	111
(4) Visits in connection with Government water conservation works	106
(5) Visits in connection with water supplies, Townships and Government Institutions	86
(6) Farmers' Associations, meetings attended	6
(7) Miscellaneous visits	89
Total	830
Visits paid by local assistants on soil conservation	116
Grand total	946

The item "Miscellaneous Visits" mainly includes visits of inspection made by the Hydrographic Engineer on Water Court work and visits made by the Chief Engineer when sitting as Assessor on the Water Court.

In addition it includes a few visits made in connection with water supplies for mines. The visits performed by officers of the Division during the previous three years are as under:—

1932	289
1933	358
1934	394

It should be noted that although the number of visits paid during the year under review are more than double those performed in the previous year, the expenditure on travelling and transport was only increased by £380 (*i.e.*, approximately 20%) plus £50 for travelling expenses of the local technical assistants.

The number of visits performed from the Bulawayo office totalled 421 for the year as compared with 163 for the previous year, and is striking proof of the increased interest being displayed by the Matabeleland farmer in water conservation works, which are now regarded as the first essential for successful farming.

Details of the work performed are given under the separate headings.

Irrigation and Water Conservation — Private Farms.— A number of minor irrigation schemes have been advised on this year and greatly increased activity has been displayed in the construction of irrigation schemes for the purposes of growing wheat and lucerne.

In Mashonaland 25 small irrigation schemes were favourably reported on, the total acreage irrigable being 582 acres.

In Matabeleland the Irrigation Engineer reports that more than sixty dam sites have been surveyed and inspected and that several dams of more than average size have been built for irrigation purposes.

Statistics for 1935 are not available yet, but the 1934 figures show a total area of 23,320 acres under winter crops, *i.e.*, an increase of $11\frac{3}{4}$% over the figure for 1933.

The following are the figures for wheat production for 1934:—

	Acreage.	Yield (bags).	Bags per acre.
Irrigated wheat	4,781	12,050	2.5
Non-irrigated wheat	11,620	16,544	1.4

The considerable reduction in the area of wheat under irrigation, being 1,650 acres less than in 1933, is remarkable and can only be attributed to the fact that, as most of the small irrigation schemes are purely diversion schemes of the

normal stream flow without storage facilities, the lessened stream flow available owing to the succession of dry years necessitated a reduction in the area placed under irrigation. The reduction in the yield per acre of irrigated wheat, *viz.*, 2.5 bags as compared with 3.3 bags in 1933, is due to the mild winter causing an undue prevalence of rust.

It is noteworthy that in Charter district, which is the principal wheat growing district in the Colony, the yield per acre of irrigated wheat was 5.1 bags as compared with 1.2 bags per acre from "vlei" lands, the actual figures for that district being 2,870 bags from 566 acres of irrigated land and 5,753 bags from 4,761 acres of "vlei" land.

As stated previously, the necessity for water conservation works in Matabeleland is now thoroughly realised, and the Government policy of providing loan money on easy terms for the construction of these works is gradually being appreciated and put into effect by the owners concerned.

The construction of storage dams on the main stock routes, two of which will be started shortly in the Bulawayo-Plumtree road, should afford an object lesson of the benefit of these works.

Soil Conservation.—The propaganda conducted by the two Soil Conservation Advisory Councils and local sub-committees of certain of the Farmers' Associations has resulted in a very considerably increased demand for advice in setting out the necessary works. It was only possible to meet the demand by the appointment of three farmers as local technical advisers, and the thanks of the Department are due to these individuals, who performed most valuable work in their respective areas.

In addition, three demonstrations on the use of ridging implements were carried out under the auspices of the Concession and Glendale Sub-Committees and were very effective in demonstrating the ease with which the ridges could be constructed—all the demonstrations were well attended by farmers in the locality.

Interesting data has been obtained from the Soil Conservation Station at Glenara, which indicate that the loss of soil from protected lands is less than 1/20th of that from

unprotected lands, and that in addition the ridges are very effective in reducing flood run-off and therefore are of material benefit in conserving water in the soil.

Another station is at present being established in Matabeleland, for which records should be available this season.

The total area of land protected this year as a result of visits by officers of the Division and local technical assistants amounts to 11,040 acres, ridge terracing constructed to the extent of a total length of 367 miles and storm drains to the length of 47 miles dug. The following summary sets out the length of ridge terracing constructed and the areas of land protected annually since 1929, of which records are available in this office of advice given.

Year.	Miles of Ridge Terracing.	Acres of land Protected.
1929	76	2,280
1930	103	3,090
1931	150	4,500
1932	108	3,240
1933	132	3,960
1934	126	3,780
1935	367	11,040
Totals	1,062	31,890

The tremendous impetus given to the construction of these essential works by the propaganda conducted this year is reflected in the above figures, as the work carried out this year more than exceeds the total for the previous three years.

If this pace can be maintained, or even accelerated, for a few more years there will be some hope of conserving the soil on all arable lands that required protection before they have been entirely ruined by erosion.

The three local technical assistants were responsible for the setting out of 201 miles of ridges and the protection of 6,060 acres of land.

Their assistance has been invaluable, as without their aid it would have been impossible to meet the demand, as the one Assistant Engineer at Salisbury himself created a record by setting out 150 miles of ridges for the protection of 4,500 acres.

In Matabeleland 18 visits were paid in connection with soil erosion and 450 acres of land protected, so it is evident that that portion of the Colony is also beginning to realise the importance of soil conservation works.

Irrigation Loans.—In all some forty-three applications for loans for water and soil conservation and irrigation were received.

Of these twenty-seven were approved for a total sum amounting to £3,455, eleven are still under consideration and amount to a total of £2,340, and five applications were refused.

Of the loans approved thirteen were for works in connection with irrigation purposes, nine for water conservation works, three for soil conservation works and two for boring.

Government Irrigation Loans.—During the year the construction of the Umgusa scheme, 12 miles from Bulawayo, was authorised. The scheme comprises an earthen storage dam capable of storing 800 acre feet of storm water and irrigating 200 to 300 acres of Government-owned land; in addition two private owners below the dam will benefit to a limited extent. It is intended to sub-divide the Government-owned land into small holdings with about 15 acres of irrigable land on each holding and lease out these holdings to suitable tenants on reasonable terms.

Work on the dam was commenced in May last. The site of the dam has been cleared, a portion of the spillway excavated, the training bank nearly completed, the core trench excavated, the concrete core wall across the river bed to underlying rock has been completed and a portion of the clay core placed, the pick-up weir built about a quarter of a mile downstream of the dam, and a number of boreholes drilled into the rock across the river bed and cement grout forced in under pressure.

This initial work will all be completed departmentally by the end of the financial year and the construction of the earthen embankment itself will be let out to contract about April next.

The cost of the work to date is £1,965 and the cost to the end of the financial year will probably amount to £2,500, but plant and equipment to the value of £300, which have been charged to the vote, will be available for use elsewhere.

Further developments have also taken place in connection with the Popotekwe and Umshandige schemes, the latter having been authorised for construction next year, and preliminary designs and estimates are in course of preparation for the Popotekwe scheme. Gauging weirs have been built on both rivers and flood recorders will be installed at an early date.

Acting on the recommendations of the sub-committee appointed by the Rhodesia Stockowners' Association a thorough survey of possible dam sites was carried out on the Plumtree-Bulawayo road.

Two of the most suitable sites have been selected and the construction of earthen storage dams commenced—the dams being respectively 20 and 40 miles from Bulawayo.

Water Conservation and Irrigation in Native Areas.—The policy of constructing water conservation works in Native Reserves and Purchase Areas was continued at an accelerated rate during the year and works on a bigger scale than that previously adopted have been constructed. All the construction work has been carried out departmentally with European supervisors in charge of native gangs—fourteen supervisors were employed during the year for varying periods.

Details of the construction work in the various areas are as under:—

Nata Reserve.—Three earthen storage dams under construction and repairs to two dams completed.

Semokwe Reserve.—One concrete weir and one earthen storage dam under construction and one concrete weir heightened.

Insiza Reserve.—One earthen storage dam completed and one concrete weir under construction.

Belingwe Reserve.—One concrete weir under construction.

Maranke Reserve.—One earthen storage dam completed.

Codhlawayo Native Purchase Area.—One concrete weir required.

Msengesi Native Purchase Area.—One earthen storage dam and one concrete weir completed.

In addition one small earthen storage dam and one concrete weir are under construction at the Native Village Settlement near Bulawayo. The construction of these dams and weirs departmentally has resulted in considerable saving of construction costs but has increased the administrative and inspection duties necessary.

Owing to shortage of staff the construction of these works was delayed until somewhat late in the season this year with resultant difficulties owing to lack of water to consolidate the banks.

Costs would be further reduced if construction could be commenced immediately after the rainy season, and this should be possible next year, as there is now a staff of trained supervisors available, if approval can be obtained for the expenditure to be incurred prior to the passing of the Estimates.

Extensive surveys for works next year have been carried out in the Insiza, Chibi, Nata, Mphoengs, Semokwe, Gwaai, Wankie, Lower Gwelo and Que Que Reserves, and also in the Wankie and Robin's Game Reserves.

A temporary engineer was employed for a period of five months on a survey for an extensive irrigation scheme from the Sabi River to serve the M'Kuni Native Purchase Area and the western side of the Maranke Reserve.

The field work has been completed and the plans and estimates will be prepared next year. The survey shows that an area of some 2,000 acres of irrigable land is commanded in the Purchase Area, but that it would not be economical to

extend the scheme to serve land in the Native Reserve. In addition a limited amount of suitable irrigable land will be commanded on Crown land farms upstream of the Purchase Area.

The engineer also carried out surveys for three relatively small irrigation schemes in the Zimunya and Mutambera Reserves.

Water Supplies: Townships.—The construction of a concrete storage dam with earthen flank abutements to store 31 million gallons of water in the Tegwani River for the water supply of Plumtree was commenced at the beginning of October and will be completed at an early date and will be available for the storage of flood water this season.

The work was let out to contract with a resident clerk-of-works.

Tenders for the 4-inch pumping main five miles in length will be called for early in January and contracts for the pumping installation and the reticulation system will also be let before the end of the financial year. The Gwanda water supply scheme was completed early in the year at a total cost of £2,357. Provision is to be made next year for fencing the conservation basin, installing filtration and purification plant and increasing the storage in the service reservoirs.

The scheme has been very successful and has been capable of supplying an average demand of 12,000 gallons per diem.

A water supply scheme for Marandellas Village was also installed during the year—the scheme comprised the installation of an engine and pumping equipment in a borehole in the Native Messengers' Camp and delivering the water into the existing storage tanks in the township distant about 1½ miles from the borehole.

Specifications, plans and estimates for a gravitation scheme from the springs on the Citrus Estate to serve the township of Sinoia have been prepared. Tenders will be called for at an early date and the work completed before the end of the financial year.

The Village Management Board of Penhalonga were advised on improvements to their existing water supply scheme, but questions of finance have up to date prevented the recommendations being put into effect.

Water Supplies: Government Institutions. — Pumping schemes have been installed at Ndanga, Filabusi, Matopo Terminus, Mtoko, Mazoe, for the native school at Tjolotjo, for the native village at "Helenvale" near Bulawayo, and at the Tobacco Research Station, Trelawney. A hydraulic ram pumping scheme has been installed at Zaka.

A well has been sunk near the new Native Department station at Sipolilo and a pumping installation is at present being installed, but is not yet completed. The water supply for the Matopos Hotel was re-organised and a lighting plant installed and arrangements made for conversion to automatic operation.

The work of improving the Malemi storm canal on the Matopos Estate was completed.

Advice and supervision has also been given in several minor supplies.

Surveys have been made and estimates prepared for a number of minor supplies, one being on a relatively large scale for the Ngomahuru Leper Settlement.

Miscellaneous Visits.—These included attendance of members of the staff as technical witnesses before Water Courts and also inspections carried out for the Water Court.

Under this heading are also included visits to the Trelawney Tobacco Experiment Station to superintend the erection of buildings and the installation of a water supply. It also includes surveys and investigations carried out on the Umsingwane and Bembesi Rivers with a view to determining suitable storage sites for the mines and Liebig's Factory near West Nicholson.

Surveys of suitable storage sites to supply mining properties were also carried out on the Bembesi River, near Inyati, and on the Insiza River, near Filabusi.

Boring.—During the year the number of drilling machines in operation was eleven, which were all in operation for the full year, but a certain amount of drilling time was lost owing to the lengthy moves involved for some of the machines, which resulted in a lower average footage per month being bored than in the previous year.

In addition a number of boreholes were sunk at the bottom of existing wells in Matabeleland which involved loss of drilling time whilst casing was being fixed in the wells.

The above two causes combined with the fact that the average depth per borehole was 17 feet deeper than in the previous year resulted in 26 fewer boreholes being drilled than in 1934.

The following summary sets out footage drilled, number of boreholes sunk and the average costs:—

	Private applicants.	Municipalities & Townships.	Mines.	Government Institutions.	Native Purchase Areas.	Native Reserves.	Totals, etc.
Total depth drilled	4602	1016	2006	1727	877	5908	16136
Total depth drilled on which rebates have been granted	1528	645	—	—	—	—	2173
Number of drill months occupied	39.5	9.5	10.5	12.5	13.0	47.0	132.0
Footage drilled per working month per drill... ...	116	107	191	138	68	126	122
Number of boreholes sunk	36	11	12	12	7	40	118
Average depth of boreholes ... ... ft.	127	92	167	144	125	148	136
Average cost per foot at full tariff rates	17/9	19/-	20/10	24/10	27/-	19/4	20/-
Average cost to applicants per foot drilled on which rebates have been granted	7/2	10/8	—	—	—	—	8/2
Percentage of successful boreholes...	65.9	36.3	60.0	75.0	28.5	52.5	57.6

Boring for private applicants during the year has resulted in an increased cost as compared with 1933 of 2s. 2d. per foot drilled.

As previously stated, this increased cost is chiefly due to the number of boreholes sunk at the bottom of existing wells.

The figure given this year is the average cost per foot of the total footage drilled for private applicants assuming that full tariff rates were charged in each instance.

This will enable a standard figure to be available each year irrespective of the amount of rebates granted—in addition a figure is given indicating the average cost per foot paid by applicants for footage drilled on which rebates were granted. It will be noted that this is less than half the average cost, although the maximum rebate is only 50% of the full tariff rates, as the footage cost of such boreholes is usually low, as the casing is almost invariably recovered and therefore is not charged for.

It is satisfactory to record an increase in the percentage of successful boreholes from 56.6% in 1934 to 63.9% in the present year. During the coming year it is intended to carry out geophyiscal prospecting at all difficult sites, and it is hoped by this means to increase the percentage of successful holes and reduce the amount granted in rebates.

Boring for Municipalities shows a very low percentage of successful holes, *viz.*, 36.3% actually, however, is most of the holes classed as failures an ample supply of water was developed but the water was so highly charged with fine silt that the holes were useless for pumping purposes.

The boring was carried out for the Umtali Municipality and the Bindura Township.

The bulk of the work for development of water supplies for mines was carried out on behalf of a large mining company in the Wankie district and the average cost of 20s. 10d. per foot is low when it is considered that the costs include the hire of all transport and extra labour for supplying water and wood fuel.

The footage drilled for Government Institutions shows a considerable increase in that performed in the previous year and a satisfactory reduction of 3s. 5d. per foot in the average cost.

The boring in the Native Purchase Areas again shows the highest average cost of all the groups, although the figures of 27s. 6d. per foot is very satisfactory when compared with the high cost of 40s. 8d. per foot in the previous year. The high cost is due to the expense involved in moving the drills long distances to the Jenya and Maitiengwe Divisions.

The percentage of successes, however, is very unsatisfactory, due to the fact that in the Jenya Division only one successful supply was developed out of six boreholes sunk. In future it will be essential to have a geophysical survey made before any boring is undertaken in the Native Purchase Areas. The average cost of boring in Native Reserves shows a reduction of 5d. per foot on the figure for the previous year, but unfortunately the percentage of successful holes has dropped from 78.9 to 52.5%.

This unsatisfactory feature is due to the fact that all the drills were operating in difficult areas, whereas in 1934 two of the machines were operating in the basalt sandstone areas in the Gwaai and Nata Reserves where practically all the holes were certain to contain a supply.

It is satisfactory to record, however, that in one of the most difficult areas, *viz.* Belingwe Reserve, the adoption of geophysical surveying methods enabled six successful supplies to be developed.

The worst area this year was the Mtoko Reserve, where only one useful supply was developed out of seven boreholes sunk. A geophysical survey has just been completed in this area, and it is hoped that better results will be recorded next year.

The earnings of drills operating under Revenue Vote for private applicants, Government Institutions and Native Purchase Areas amounted to £10,058 after allowing for all rebates either granted or recommended, and the running cost of £8,869, thus leaving a balance of revenue over expenditure of £1,189, which is available for depreciation.

This enables the normal amount of depreciation of £150 per annum to be provided on six of the drills which operated under this Vote. No depreciation is allowed on the seventh

drill, as this was given a complete overhaul during the year at a cost of £258, which is included in the running costs given above. After an allowance of £900 for depreciation there is therefore a profit of £289 available on the year's working.

The total rebates granted or recommended during the year amounted to £662, and as the figure of £10,058 shown as earnings does not include the amount allowed for rebates, it is evident that the present policy of rebates does not involve the Government in an actual cash loss.

Details of the work performed by the drills operating under the Revenue Vote are set out in Schedule II. attached, and details relating to machines operating in Native Reserves are contained in my report to the Acting Secretary for Native Affairs.

Difficulty has been experienced this year in obtaining the services of competent drill foremen owing to the demand and the high wages offered on the Rand.

An effort was made to obtain recruits suitable for training in the work from the Technical School, Bulawayo, without result, as youths trained there appear to find ready employment on the mines and railways.

Water Supply Installations in Native Reserves.—Pumping installations and troughs were erected on successful boreholes in the Reserves, but very few windmills with storage tanks, were erected as in accordance with the wishes of the Native Department; the policy is to erect hand pumps on all boreholes except those in which the supplies are very deep-seated.

A suitable type of hand pump has been designed and has been erected on new boreholes and on a considerable number of old boreholes, replacing the old type of bush hand pumps. A new type of animal draught gear pump has been installed on a deep borehole in the Nata Reserve, and if it proves satisfactory this type of pump will be installed on other deep-seated supplies.

Geophysical Prospecting.—One of the drill foremen who had received some training in geophysical survey work was employed during the latter portion of the year in selecting

boring sites by this method in certain of the most difficult areas where selection of sites by geological surface indications had yielded most unsatisfactory results.

The main portion of the work was carried out in the Belingwe Reserve, which is typical granite formation.

Previous boring in this Reserve and in adjoining areas with similar formation had been costly and unproductive of results as shown by the following figures:—
Belingwe Native

Area.	Footage drilled.	Cost. £	No. of boreholes sunk.	No. of successful boreholes.
Purchase Area ...	1,046	1,454	11	2
Insiza Reserve ...	977	1,277	8	2
Belingwe Reserve	611	776	4	—
Nata Reserve ...	670	630	6	1
Totals	3,304	4.137	29	5

i.e., in these areas the percentage of successful holes was only about 17% and the average cost per useful supply was over £800 apiece. It is obvious why it had been practically decided to abandon boring in these and simlar areas until the geophysical prospecting method offered a possible solution of the problem. The improvement which resulted from the aodption of this method is indicated in the following summary:—

Area.	Footage drilled.	Cost. £	No. of boreholes sunk.	No. of successful boreholes.
Belingwe Reserve	999	1,107	7	6
Nata Reserve ...	926	871	5	3
Chibi Reserve ...	487	542	2	1
Totals	2,412	2,520	14	10

i.e., the percentage of successful holes has improved to over 70% and the cost per useful supply reduced to only £252 apiece.

These figures are sufficiently striking to emphasise without further comment the value of the method and the fact that the salary and expenses of the official engaged on this work are minor compared to the savings effected.

In addition a number of sites for private applicants in the neighbourhood of Bulawayo have been selected by this method without any failures, so the general adoption of the method should effect a marked reduction in the claims for rebates. During the forthcoming year it is intended to continuously employ an official on this type of work and appoint him as a Junior Boring Inspector.

The method is essentially one which enables electrical resistances at depth to be measured and recorded. As lower resistance than those in the overlying formation may be associated with either water bearing strata or a change of geological formation it is evident that 100% successes cannot be hoped for, but as a change of formation is often a fissured zone carrying water it can be expected that an average of 70% successes should be maintained.

The method is infinitely superior to so-called water divining, which has many advocates, as the personal factor is entirely eliminated as definite measurements are recorded and plotted in the form of graphs, which can be more and more correctly interpreted as experience is accumulated of the area concerned.

Meteorology.—The number of stations in operation at the beginning and end of the year was as follows:—

Equipment.	1.1.35.	31.12.35.
Dines anemometers, etc.	6	6
Barometric...	23	22
Climatological	19	15
Rainfall	550	575
Total	598	618

All observations have been checked by means of check maps, and wherever possible against charts from automatic instruments. All charts from the instruments at Salisbury and Bulawayo have been fully reduced, but it has not been

found possible to reduce the charts from other stations. It is hoped that during the coming year a start will be made on regular reductions of charts from at least the most important of the outstations. Upper air observations have continued at Salisbury and Bulawayo, but most observations have been for aircraft purposes, and have extended to a height of only 7,000 feet above the surface. With a view to getting observations at higher levels, another observer takes over whenever possible, and continues the observation to 15,000 feet.

Weather Reports and Forecasts.—The broadcast of weather messages from Salisbury at 08.30 GMT has continued throughout the year, and recently the upper air observations from Salisbury and Bulawayo have been added when available. Daily telegrams are sent from a number of stations to the Union Meteorological Office. Wireless reports are received from Madagascar, Portuguese East Africa and Northern Rhodesia. As yet no daily messages are received from the remainder of the British East African group, but copies of telegrams have been received twice weekly by air mail, and a good number of them have been plotted on the maps, and have shown the desirability of extending the daily map to cover this area.

The system of distributing forecasts only to districts from which applications had been received was put into operation at the beginning of the year. Since that time, and notably at the beginning of the present season, quite a number of additional applications have been received. The forecasts are issued three times a week, and the forecast covers a period of two days subsequent to the day of issue. It is not always possible to forecast with confidence for this period, but a good measure of success has been obtained, and the greater usefulness of a longer period forecast seems to justify a slight decrease in accuracy.

Aviation Meteorology.—Reports have been given to all Imperial Airways machines passing through the country. The system of special reports is somewhat clumsy, especially when aeroplanes are behind schedule time, which has occurred frequently in recent months. At the beginning of the present rainy season reports were arranged for R.A.N.A. schedule flights. This company is now operating regular services

between Salisbury and Beira as well as the service to Nyasaland. An officer is on duty at Salisbury from 6 a.m. every morning (except Sundays), but the full system of collecting routine reports from stations on air routes has not yet been put into operation.

The offices and quarters adjacent to the aerodromes at Salisbury and Bulawayo are now in course of erection, and it is anticipated that they will be ready for occupation by May, so that the weather service for aircraft should be organised by 1st July.

Publications.—The annual report for the year ended 30th June, 1935, has just been completed and is ready to be forwarded to the printers. The usual monthly bulletins have been issued. No seasonal forecast has been officially issued for the season 1935-36. The factors of Equation 11 indicated no deviation from normal, but up to the time of writing rainfall is considerably below normal, no set-in rains having fallen as yet.

Meteorological Conferences.—The Meteorologist attended the Empire Conference of Meteorologists in London and the International Meteorological Conference at Warsaw during the year.

Much valuable experience was gained at these conferences and another most useful result was the opportunity afforded for discussions and the personal contacts formed with Meteorologists in other portions of the world.

One important outcome of the International Conference was the resolution adopted to form a regional Commission for African meteorology, which has been long overdue, and the first meeting is to be convened at Lusaka in August next.

Hydrography.—Apart from reports and inspections in connection with applications for water rights submitted to the Water Court the Hydrographic Engineer and Meteorologist has not been able to arrange for the reduction of any of the data from the gauging stations on the thirteen catchments under observation and no hydrographic report has been issued since 1931.

The lack of reliable hydrographic data will be a serious disadvantage now that it has been decided to proceed with the construction of major irrigation works, and authority has been requested for the appointment of a Hydrographic Engineer who will relieve the Meteorologist of these duties, as the latter official's time is fully occupied with his own specialised work.

Water Ordinance.—The writer and the Hydrographic Engineer sat as Assessors on five Water Courts during the year. In all 114 applications were dealt with, comprising 50 irrigation, 37 mining, 7 development of power and 20 miscellaneous applications.

Authority was sought to irrigate a total of 11,936 acres, but the irrigation of only 959 acres was authorised.

The large difference between the irrigable areas authorised and the areas applied for being due to the fact that three large areas applied for in Native Areas were not granted and to the invariable practice of applicants to apply for a considerably larger area than can be irrigated from the water supply available. Of the total number of applications dealt with by the Courts, nine were dismissed; nine, involving an irrigable area of 1,415 acres, were deferred pending further investigation.

The Hydrographic Engineer and the Assistant Engineers reported in detail on a number of applications which saved expenditure, as the Court was not required to visit the areas concerned.

Southern Rhodesia Weather Bureau.

JULY, 1936.

Pressure.—Barometric pressure was uniformly high over the greater part of the country, averaging 1 millibar above normal.

Temperature.—The mean temperature for the month was about normal.

Note.—The results for July and all succeeding months for Salisbury and Bulawayo will be taken from the new observatories, the height of the barometer at Bulawayo is 4,393 feet (33 feet lower) and at Salisbury 4,831 feet (54 feet lower).

JULY, 1936.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	87	42	72.9	49.6	61.2	60 4	58.5	55 4	83	53	...	0.38	0.15	6	...
Beitbridge...	973.2	...	91	38	76.8	46.1	61.5	...	56.8	50.4	64	45	1 7	0 00	0 25	...	1,500
Bindura...	897.8	...	81	39	71.7	45.9	58.8	..	57.0	50.5	64	45	3.5	0 01	0 04	1	3,700
Bulawayo	875.7	874.5	79	39	68.1	44.7	56.4	56.8	54.6	47.2	58	40	3.0	0.00	0.05	..	4,393
Chipinga	899.2	...	81	44	66.7	49.3	58.0	..	58.3	52.7	71	49	3.8	1.98	0.63	7	3,685
Enkeldoorn...	863.4	...	79	38	66.3	44.5	55.4	56.1	54.1	48 7	67	44	3.6	0.19	0.09	1	4,788
Fort Victoria	902.5	901.4	84	36	69.3	42.7	56.0	55.0	53.6	48.9	72	45	2.3	0.26	0 11	5	3,571
Gwaai Siding	910.7	...	86	34	76.6	41.3	58.9	...	53.7	47.2	61	41	2 2	0.00	0.00	...	3,278
Gwanda...	913.5	...	85	37	71.3	44.0	57 6	...	54.3	48.3	65	43	2 7	0.00	0.08	. .	3,233
Gwelo	868.1	...	80	36	66.9	43.3	55 1	55.5	52.9	47.2	66	42	2.5	0.06	0.02	1	4,629
Hartley...	891.7	...	82	38	72.0	43.7	57.8	58.2	56 0	49.3	61	44	2.5	0.02	0.01	1	3,879
Inyanga...	842.0	...	76	36	64.6	41.7	53.2	...	53 8	47.5	64	42	3.0	0.43	0.15	3	5,503
Marandellas	842.8	...	76	35	64.1	44.1	54.1	...	51.9	46.8	70	42	3.9	0.00	0.08	...	5,453
Miami	884.7	...	80	39	70.1	45.5	57.8	...	57.0	51.4	69	47	3.4	0.13	0.10	4	4,090
Mount Darwin ...	913.8	...	83	36	73.6	44.3	59.0	..	59.2	53.7	71	49	3.5	0.17	0.01	2	3,179
Mount Nuza	805.8	...	64	35	51.8	40.7	46 3	...	45 7	43.0	83	41	5.4	2.26	...	14	6,668
Mtoko	883.2	...	80	43	69.6	49.2	59.4	...	58.1	51.7	65	47	2.5	0.10	0.03	2	4,141
New Year's Gift. .	...	...	89	44	72.2	48.5	60.4	...	56.1	52.2	77	48	...	0.71	0.24	7	2,690
Nuanetsi	970.8	...	89	37	76.7	44.2	60.4	...	58.8	52.7	67	48	3.0	0.08	0.04	2	1,581
Plumtree	870.1	...	79	42	68.8	47.1	58.0	..	55.7	46 5	50	38	1 5	0.00	0.05	...	4,549
Que Que	888.1	...	82	38	71.5	45.0	58.3	...	55.8	49.5	64	44	2.4	0.00	0.02	...	3,999
Rusape	868.2	...	79	36	65.7	42.7	54 2	.	52.7	48 8	77	46	3.7	0.40	0.21	4	4,648
Salisbury	861.7	860.9	82	37	69.3	44.5	56.9	56 3	56.1	49.0	60	42	3.1	0.02	0.03	2	4,831
Shabani...	917.6	...	85	38	70.9	45.1	58.0	...	58.2	51.3	63	46	2.5	0.12	0.03	3	3,131
Sinoia	894.6	...	85	34	73.5	40.3	56.9	...	56.5	50.0	63	44	2.3	0 00	0.03	...	3,795
Sipolilo	891.0	...	81	40	70.9	46.9	58.9	...	60.3	52.1	57	45	2.6	0.00	0.03	. .	3,876
Stapleford	847.6	...	...	32	...	39.6	...	...	49.2	48.0	91	47	5.8	2.39	0 20	8	5,304
Umtali...	899.6	898.4	85	43	69.4	47.4	58.4	58.4	56.5	52.9	80	50	4.9	0.58	0.28	4	3,672
Victoria Falls... ...	...	...	...	...	...	...	...	...	.	...	...	...	.	0.00	0 00	..	3,009
Wankie	933.9	...	91	46	80.1	53.1	66.6	..	59.2	50.9	56	44	2.2	0.00	0.01	...	2,567

Southern Rhodesia Veterinary Report.

JUNE, 1936.

No fresh outbreaks of scheduled diseases reported.

MALLEIN TEST.

Forty-three horses and 22 mules. No reaction.

TUBERCULIN TEST.

Two bulls and 8 cows; with negative results. Ten cows on Wakefield farm, Makoni district, were re-tested and seven animals gave positive reactions.

IMPORTATIONS.

From the Union of South Africa.—Two bulls, 34 horses, 22 mules, 466 sheep.

From Bechuanaland Protectorate.—751 sheep.

EXPORTATIONS.

To Union of South Africa.—One horse; re-exports 16 horses.

To Nyasaland.—Eight horses.

EXPORTATIONS—MISCELLANEOUS.

To United Kingdom in Cold Storage.—Chilled beef quarters, 6,713; frozen boned beef quarters, 6,561; frozen beef quarters, 10,026; briskets, 71 lbs.; shoulders, 448 lbs.; middles 44 lbs.; buttocks, 82 lbs.; kidneys, 5,017 lbs.; tongues, 19,826 lbs.; livers, 29.139 lbs.; hearts, 15,906 lbs.; tails, 8,419 lbs.; skirts, 7,461 lbs.; shanks, 10,172 lbs.

Meat Products.—From Liebig's Factory.—Corned beef, 129,850 lbs.; meat extract, 23,460 lbs.; beef powder, 100,815 lbs.; beef fat, 96,000 lbs.; meat meal, 24,000 lbs.; tongues, 1,800 lbs.

G. C. Hooper Sharpe,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-36.

Monthly Report No. 44. July, 1936.

Winged swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) have been reported from seven districts during the month, namely, Salisbury, Mrewa, Lomagundi, Mazoe, Ndanga, Victoria and Inyanga.

Some of these swarms have been described as large. No prevalent direction of flight is apparent from the reports, all four points of the compass being included.

The situation may be regarded as favourable compared with the preceding years of the present invasion.

RUPERT W. JACK,
Chief Entomologist.

Departmental Bulletins.

The following Bulletins are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

N.B.—The date the article appeared in the Journal is indicated in abbreviated form before the number, e.g., 8/22, No. 429, means that Bulletin 429 appeared in the Journal for August, 1922.

AGRICULTURE AND CROPS.

3/31. No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

4/31. No 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

5/31. No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

9/31. No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

10/31. No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

11/31. No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

12/31. No. 837. Veld Grass Silage: A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.

1/32. No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulip Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

6/32. No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.

8/32. No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.

2/33. No. 878. A.I.V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.

11/34. No. 936. Witchweed, by S. D. Timson, M.C. Dip.Agric. (Wye), Assistant Agriculturist.

10/35. No. 970. Rhodes Grass for the Southern Rhodesian Tobacco Grower, by African Explosives and Industries, Ltd.

11/35. No. 972. Notes on Witchweed, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

2/36. No. 978. Organic Manure in Relation to Wheat Growing in Rhodesia: Its Importance and How to Produce It, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

3/36. No. 982. Weeds: Control of Weeds on Footpaths and Tennis Courts, by S. D. Timson, M.C., Assistant Agriculturist.

6/36. No. 992. Annual Report of the Agriculturist for the year 1935, by D. E. McLoughlin, Agriculturist.

7/36. No. 994. Some Notes on Cotton Growing, by J. E. Peat, Senior Plant Breeder, Cotton Station, Gatooma.

REPORTS ON CROP EXPERIMENTS.

7/27. No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

4/28. No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

7/29. No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

7/30. No. 789. Agricultural Experiment Station, Salisbury. Annual Report of Experiments, 1928-29, by H. C. Arnold.

9/31. No. 830. Salisbury Agricultural Experiment Station, Annual Report, 1929-30, by H. C. Arnold, Manager.
10/32. No. 864. Annual Report, 1930-31: Agricultural Experiment Station, by H. C. Arnold, Station Manager.
6/33. No. 895. Salisbury Agricultural Experiment Station Annual Report, 1931-32, by H. C. Arnold, Manager.
3/34. No. 914. Gwelo Municipal Demonstration Station: Final Report, 1933, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
9/35. No 965. Salisbury Agricultural Experiment Station Annual Report, 1933-34, by H. C. Arnold, Manager.

TOBACCO.

8/26. No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
9/26. No. 615. The Culture of Virginia Tobacco in Southern Rhodesia: Field Management, by D. D. Brown.
5/27. No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.
5/27. No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
9/27. No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad)
11/27. No 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
1/28. No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
2/28. No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
12/28. No. 715. Turkish Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.
3/29. No. 728. Suggested Crop Rotations for Tobacco Growers, by D. D. Brown, Chief Tobacco Expert.
4/29. No. 734. Common Faults in Curing Virginia Bright Tobacco, by D. D. Brown, Tobacco and Cotton Expert.
8/29. No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
9/29. No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
2/30. No. 771. Dark Fire-cured Tobacco: Field Operations, by D. D. Brown, Chief Tobacco Expert.
3/30. No. 774. Dark Fire-cured Tobacco: Harvesting and Curing, by D. D. Brown, Chief Tobacco Expert.
6/30. No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
3/31. No. 812. Selection of Tobacco Seed Plants, by H. F. Ellis, M.Sc., B.S. (Agric.), Tobacco Adviser.
9/31. No. 828. Seed Beds, by D. D. Brown, Chief Tobacco and Cotton Expert.

LIVE STOCK.

6/34. No 924. Raising Dairy Calves on a Limited Amount of Whole Milk, by C. A. Murray, M.Sc., Agr., Animal Husbandry Officer, Matopo School of Agriculture and Experiment Station, Rhodes Matopo Estate.

1/35. No. 943. Cattle Improvement and a Cattle Breeding Policy in Southern Rhodesia: A Review of the General Position Chiefly as regards Ranching Cattle, by Dr. A. E. Romyn, Chief Animal Husbandry Officer.

1/35. No. 944. Pig Feeding Demonstration: The use of Balanced and Unbalanced Rations for Growing Pigs, by C. A. Murray, M.Sc. (Agr.), Senior Animal Husbandry Officer I/C., Matopo School of Agriculture and Experiment Station.

1/35. No. 945. A Home-made Cow Stanchion, by Major R. R. Sharp, Whinburn, Redbank.

3/35. No. 946. Economical Rations for Wintering Dairy Cattle, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Matopo School of Agriculture and Experiment Station.

5/35. No 952. Annual Report of the Chief Animal Husbandry Officer for the year ending 31st December, 1934, by A. E. Romyn, Chief Animal Husbandry Officer.

7/35. No. 959. The Selection of a Dairy Bull, by A. E. Romyn, Ph.D., Chief Animal Husbandry Officer.

3/36. No. 981. The Dehorning of Cattle intended for Slaughter and Export, by B. A. Myhill, Assistant Chief Veterinary Surgeon.

4/36. No. 984. Report on the Curing of Rhodesian Hides, by Advisory Committee on Hides and Skins of the Imperial Institute.

4/36. No 985. Export of Frozen Porkers. Third Consignment to Smithfield. Division of Animal Husbandry.

5/36. No. 987. The Curing of Hides and Skins on the Farm, by The Division of Animal Husbandry.

5/36. No. 988. Preparing Cattle for Show, by The Animal Husbandry Division.

6/36. No. 989. The Supplementary Feeding of Mineral and Protein Supplements to Growing Cattle in Southern Rhodesia and its Relation to the Production of Beef Steers, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate; A. E. Romyn, Ph.D., Chief Animal Husbandry Officer, Department of Agriculture, Southern Rhodesia; D. G. Haylett, Ph.D., Director, Rhodes Matopo Estate; F. Ericksen, Dip. Agric., Experimentalist.

DAIRYING.

1/28. No. 667. Farm Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.

3/29. No. 730. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.

12/30. No. 799. The Objects of Ripening Cream for Butter-making, and a few Hints on Cream Production, by F. Lammas, Dairy Officer.

4/31. No 818. Farm Butter-making. Issued by the Dairy Branch.

9/32. No 862. Cream Cheese, by F. A. Lammas, Dairy Officer.

3/33. No. 880. Dairy Tests and Calculations, by F. A. Lammas, Dairy Officer.

5/34. No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by G. B. Gundry, A.I.Mech.E.

7/34. No. 926 Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A I.Mech.E.

12/34. No 937 Gouda or Sweet Milk Cheese, by F. Lammas, District Dairy Officer.

2/36. No. 977. Notes on the Feeding of Dairy Cows during the Summer Months, by A. E. Romyn, Chief Animal Husbandry Officer.

6/36. No. 990. Southern Rhodesia Milk Recording Scheme.

VETERINARY.

10/14. No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.

4/25. No. 536. Inoculation of Cattle against Redwater and Gall Sickness, by Ll. E. W. Bevan, M.R.C.V.S.

12/25. No. 570. The Spaying of Bovines, by G. C. Hooper Sharpe, M.C., M.R.C.V.S., and M. H. Kingcombe, M.R.C.V.S.

6/26. No. 597. Suspected Poisoning of Stock: The Proper Procedure, by M. H. Kingcombe, M.R.C.V.S. (Lond.), and A. W. Facer, B.A. (Oxon.), A.I.C.

12/26. No 618. Notes from the Veterinary Laboratory: Quarter Evil, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

1/28 No. 666. Notes from the Veterinary Laboratory: Praemonitus—Praemunitus, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

4/29. No. 739. The Laboratory Diagnosis of Animal Diseases: A Note to Emphasise some Points in the Preparation and Forwarding of Specimens, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

10/29. No. 756. Parasitic Gastritis of Cattle, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

11/29. No. 760. A Note on Sheep Diseases in Southern Rhodesia, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer, Department of Agriculture, Salisbury.

2/30. No 772. Notes from the Veterinary Laboratory: Ophthalmia, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

4/31. No. 819. Measles in Swine, by P. D. Huston, M.R.C.V.S.

10/32. No. 866. The Treatment of Intestinal Parasites of Sheep, by J. D. Coutts, D.V.S., M.R.C.V.S.

4/33. No. 886. A Preliminary Note on Contagious Granular Vaginitis in Southern Rhodesia, by D. A. Lawrence, B.V.Sc., Acting Director Veterinary Research.

5/34. No. 921. Myiasis (Screw-Worm) in Cattle in Southern Rhodesia, by D. A. Lawrence, Director of Veterinary Research, and A Cuthbertson, Entomologist.

IRRIGATION, WATER SUPPLIES AND SOIL EROSION.

3/27. No. 633. The Cost of Pumping for Irrigation, by R. H. Roberts, B.Sc. (Eng.).
4/27. No. 640. Levelling for Irrigation, by Dr. W. S. H. Cleghorn, M.I.Mech.E.
11/27. No. 659. The Hydraulic Ram, revised by P. H. Haviland, B.Sc.
11/27. No. 660. Small Earthen Storage Reservoirs, by C. L. Robertson, B.Sc.
11/28. No. 668. The Water Act, 1927, by C. L. Robertson, B.Sc. (Eng.), A.M.I.C.E.
1/28. No 670. Irrigation Canals, by P. H. Haviland, B.Sc. (Eng.).
5/30. No. 782. Reinforced Concrete Water Tanks, by R. Hamilton Roberts, B.Sc. (Eng.).
6/30. No. 786. Low Concrete Dams, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
2/31. No. 808. The Application of Water in Irrigation, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
3/31. No. 811. Irrigation Canal Structures, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
8/32. No. 860. Soil Drainage and Utilisation of Vleis, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
2/33. No. 879. Conditions Governing the Hire of Government Boring Machines.
8/33. No. 900. Three Types of Water Tank, by R. H. Roberts, B.Sc. (Eng.), A.M.I.C.E., Assistant Irrigation Engineer.
6/34. No. 923. Soil Eroison, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).
6/35. No 956. Annual Report of the Division of Irrigation for the year ended 31st December, 1934, by P. H. Haviland, B.Sc. (Eng.), Acting Chief Irrigation Engineer.
8/35. No. 963. The Dangers of Soil Erosion and Methods of Prevention.
9/35. No. 964. The Use of Ditchers for Constructing Contour Ridges, by C. Tapson, Devondale, Concession.
9/35. No. 967. How to use an Engineer's or Farm Level, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).
12/35. No 973. Domestic Water Supplies and Sanitation on the Farm, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).
3/36. No. 980. Results from Glenara Soil Conservation Experiment Station, 1934-35 Season, by C. L. Robertson, B.Sc. A.M.I.C.E., Chief Engineer, Irrigation Division, and A. D. Husband, F.I.C., Chief Chemist.
8/36. No. 989. Lining an Irrigation Furrow, by R. H. Roberts, B.S., A.M.Inst.C.E., Assistant Irrigation Engineer.

FORESTRY.

1/26. No. 575. Tending of Eucalyptus Plantations, by A. S. Thornewill, B.A.

11/29. No. 763. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.

1/30. No. 769. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.

4/30. No. 778. The Utilisation of Wood in Southern Rhodesia—Conversion and Disposal of Timber, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.

8/30. No. 791. The Utilisation of Wood in Southern Rhodesia: Fencing, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.

2/31. No. 809. Establishing Pines: Preliminary Observations on the Effects of Soil Inoculation. Issued by the Division of Forestry.

4/31. No. 817. The Raising of Forest Seedlings and Transplants on the Farm, by E. J. Kelly Edwards, M.A., Dip.For. (Oxon.), Acting Chief Forest Officer.

7/32. No. 857. Charcoal Burning on the Farm, by R. J. Allen, Forester, Rhodes Matopo School of Agriculture and Experiment Station.

11/32. No 869. Wind-breaks and Shelter Belts, by A. A. Pardy, B.Sc., Forestry.

1/33. No. 874. Tree Planting, by the Division of Forestry.

4/33. No. 888. The Vegetable Ivory Palm (Hyphoene ventricosa), by G. M. McGregor, B.Sc., District Forest Officer, Matabeleland.

8/34. No. 927. Some Facts about Tung Oil, by R. H. Finlay, B.A., Dip. For. (Oxon.), District Forest Officer.

8/34. No. 928. Some Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants suitable for the Colony, by J. W. Barnes, Manager, Government Forest Nursery, Salisbury.

12/35. No. 974. Summary of the Annual Report of the Division of Forestry for the year 1934, by E. J. Kelly-Edwards, M.A., Dip. For. (Oxon.), Chief Forest Officer.

Price List of Forest-tree Transplants, Ornamental Trees Shrubs, Hedge Plants, Creepers and Seeds obtainable at the Government Forest Nursery, Salisbury.

HORTICULTURE.

4/27. No. 637. Harvesting, Packing and Marketing of Deciduous and Tropical Fruits, by G. W. Marshall, Horticulturist.

8/27. No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

2/29. No. 725. Investigations into "Collar-Rot" Disease of Citrus, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad)

3/31. No. 814. Avocado Growing in South Africa, by Redvers J. Blatt, B.Sc., Ph.D.
5/31. No 821. Vegetable Growing in Southern Rhodesia: Lettuce, by G. W. Marshall, Horticulturist.
6/31. No. 824. Vegetable Growing in Southern Rhodesia: Tomato Culture, by G. W. Marshall, Horticulturist.
9/31. No. 829. Asparagus Culture, by G. W. Marshall, Horticulturist.
11/31. No. 834. Celery Culture, by G. W. Marshall, Horticulturist.
1/32. No. 843. Vegetable Growing in Southern Rhodesia: Onion Culture, by G. W. Marshall, Horticulturist.
2/33. No. 876. Notes on African Aloes (Parts 1-6), by H. Basil Christian, "Ewanrigg," Arcturus.
10/33. No. 905. Notes on African Aloes (Parts 7-10), by H. Basil Christian, "Ewanrigg," Arcturus.
5/34. No. 920. Citrus Fruit Growing in Rhodesia, by G. W. Marshall. Horticulturist.
7/35. No. 960. The Rhodesian Home Orchard, by G. W. Marshall, Horticulturist.

ENTOMOLOGY AND PLANT PATHOLOGY.

2/13. No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
6/15. No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
10/15. No. 219. More Household Insects, by R. Lowe Thompson, B.A.
2/21. No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.
12/24 No. 522 Notes on the Black Citrus Aphis, by C. B. Symes.
8/25. No. 548. Insect Pests of Cotton, by C. B. Symes.
4/27. No. 639. Diseased Plants for Examination: Collecting and Despatching the Material, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
9/27. No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
1/28. No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
2/28. No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
6/28. No. 696. Ticks Infesting Domestic Animals in Southern Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
11/28. No. 714. Trap Cropping against Maize Pests, by Rupert W. Jack, F.E.S., Chief Entomologist.
12/28. No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.S. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
3/29. No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
6/29 No. 742. What is Diplodia in Maize? An Answer to a Popular Question To-day, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
8/29. No. 747. Mycological Notes: (1) Seed Treatment for Maize against Diplodia; (2) Seed Treatment for Tobacco against Bacterial Diseases. Issued by authority of the Minister of Agriculture and Lands.

8/29. No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
9/29. No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
9/29. No. 754. "Pinking" of Maize: Report of a Preliminary Investigation, by T. K. Sansom, B.Sc., Plant Breeder.
6/30. No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
6/30. No. 788. A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist. Supplement No. 1.
7/30. No. 790. Notes on the Control of Some of the More Important Insect Pests of Citrus in Southern Rhodesia, by W. J. Hall, Ph.D., B.Sc., Entomologist to the British South Africa Company in Southern Rhodesia.
10/30. No. 796. The Army Worm (Laphygma exempta, Wlk.), by Rupert W. Jack, Chief Entomologist.
11/30. No. 798. The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
1/31. No. 804. Locusts in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.
8/31. No. 825. Some Common Diseases of Potatoes in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.
3/32. No. 848. Mycological Notes: Seasonal Notes on Tobacco Diseases: 3, Frog Eye; 4, White Mould; by J. C. F. Hopkins, B.Sc. (Lond.).
4/32. No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.
6/32. No. 856. A List of Plant Diseases occurring in Southern Rhodesia, Supplement 2, by J. C. F. Hopkins, B.Sc. (Lond.), Government Plant Pathologist.
9/32. No. 861. Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.
11/32. No. 868. Cultural Methods and Tobacco Whitefly in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.
5/33. No. 890. Locusts: Instructions for dealing with Flying Swarms, by the Division of Entomology.
5/33. No. 892. The Tsetse Fly Problem in Southern Rhodesia, by R. W. Jack, Chief Entomologist.
5/33. No. 893. Experiments with Tsetse Fly Traps against Glossina Morsitans in Southern Rhodesia, by R. W. Jack, Chief Entomologist.
6/33. No. 894. Mycological Notes. Seasonal Notes on Tobacco Diseases. 6. An Unusual Type of Frog Eye Spotting, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.
6/33. No. 896. A List of Plant Diseases occuring in Southern Rhodesia. Supplement 3. (New Records for period June, 1932, to May, 1933.) Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.
7/33. No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.

8/33. No. 899. The Black Maize Beetle (Heteronchus Licus Klug), by C. B. Symes.

10/33. No. 904. Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932-1933. Part I.: Control of Locusts, by R. W. Jack, Chief Entomologist. Part II.: Biological Notes on the Red Locust (Nomadacris septemfasciata, Serv.), by M. C. Mossop, A.F.C., M.Sc., Entomologist.

10/33. No. 906. The Locust Invasion of Southern Rhodesia, 1932-33, by R. W. Jack, Chief Entomologist.

2/34. No. 911. Screw Worm. A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Foreword by R. W. Jack, Chief Entomologist.

3/34. No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.

4/34. No. 915. Tsetse Fly and Game, by R. W. Jack, Chief Entomologist.

4/34. No. 917. The Life History of the Screw-worm Fly, by Alexander Cuthbertson, Entomologist.

10/34. No 934. Mycological Notes. Seasonal Notes on Tobacco Diseases. 7, Spraying in Seed-beds and Lands, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

12/34. No. 938. The Destruction and Control of Locust Hoppers, by R. W. Jack, Chief Entomologist.

1/35. No. 942. Mycological Notes. Seasonal Notes on Tobacco Diseases. 8, The Mosaic Mystery. 9, Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

4/35. No. 950. The Control of Tsetse Fly in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

4/35. No. 951. Suspected "Streak" Disease of Maize. Notice to Growers, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

6/35. No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

8/35. No. 962. The Report of the Chief Entomologist for Year ending 31st December, 1934, by R. W. Jack, Chief Entomologist.

10/35. No. 969. The Objects and Value of Seed Treatment of Maize against Diplodia, by G. M. Wickens, Ph.D. (Lond.), D.I.C., Assistant Plant Pathologist.

5/36. No. 986. Annual Report of the Division of Entomology for year ending 31st December, 1135, by Rupert W. Jack, Chief Entomologist.

7/36. No. 993. Annual Report of the Senior Plant Pathologist for year ending 31st December, 1935. Part I.: Plant Pathology. Part II.: Tobacco Research, by J. C. S. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist and Officer in Charge of Tobacco Research Station, Trelawney.

POULTRY.

1/29. No. 721. Poultry Keeping in Rhodesia: Pedigree Breeding, by H. G. Wheeldon, Assistant Poultry Expert.

4/29. No. 738. Hints to Breeders: Rearing Young Stock, by A. Little, Poultry Expert.

6/29. No. 740. Artificial Incubation, Breeding and Rearing of Chicks, by H. G. Wheeldon, Poultry Expert.
11/29. No 761. Housing and Feeding of Adult Stock, by H. G. Wheeldon, Poultry Expert.
10/30. No. 795. The Turkey, by G. H. Cooper, Assistant Poultry Officer.
1/31. No. 803. Geese, by G. H. Cooper, Assistant Poultry Officer.
9/31. No. 827. The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.
10/32. No. 865. Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Chief Poultry Officer.
11/32. No. 870. Trap Nests, by B. G. Gundry, A.I.MechE. (combined with No. 875).
12/32. No. 872. The Poultry Industry: Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.
1/33. No. 875. Another Trap Nest, by B. G. Gundry, A.I.Mech.E. (combined with No. 870).
3/33. No. 884. The Vitamins in Poultry Feeding, by G. H. Cooper, Poultry Officer, Matopo School of Agriculture and Experiment Station.
5/34. No. 918. The Moulting of Poultry: The Normal and Pullet Moult, by H. G. Wheeldon, Poultry Officer.
10/34. No. 933. Ducks on the Farm (Revised), by H. G. Wheeldon, Poultry Officer.
12/34. No. 939. The Use of Galvanised Iron in the Making of Some Appliances for Poultry Keeping, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
12/34. No. 940. A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
3/34. No. 947. Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
9/35. No. 966. Egg Marketing Bill: Draft of a Bill having for its purpose the more orderly Marketing of Eggs.
11/35. No. 971. Feeds for Poultry and How to Use Them, by G. H. Cooper, Assistant Poultry Officer.

The following pamphlets can be obtained from the Poultry Officer upon application:—

Selecting Birds for Laying Tests, by A. Little, Poultry Expert.
Tuberculosis, by A. Little, Poultry Expert.
Prevention of Disease among Poultry, by A. Little, Poultry Expert.
Preparing Birds for Show, by A. Little, Poultry Expert.
The Fowl Tick (Argas persicus), by A. Little, Poultry Expert.
Culling: A Seasonal Operation, by A. Little, Poultry Expert.
Choosing a Male Bird, by A. Little, Poultry Expert.
The Breeding Stock, by A. Little, Poultry Expert.
Diseases of the Digestive System, by A. Little, Poultry Expert.
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Partial Moult: Broodiness. Selection of Layers of Large Eggs, by A. Little, Poultry Expert.
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Seasonal Hints—August, by A. Little, Poultry Expert.
Successful Chick Rearing, by H. G. Wheeldon, Assistant Poultry Expert.
Hints to Breeders, October, by A. Little, Poultry Expert.
Abnormalities in Eggs, by A. Little, Poultry Expert.
Hints to Breeders. Prepare for the Breeding Season, by A. Little.
Respiratory Diseases, by A. Little, Poultry Expert.
Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.
The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

12/22. No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.
12/24. No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.
2/25. No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.
6/25. No. 542. Review of the Abnormal Rainfall Season, 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E.
10/28. No. 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc. (Eng.).
10/31. No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.
2/33. No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.
3/35. No. 948. The Weather, contributed by The Meteorological Office.

AGRICULTURAL BUILDINGS.

9/25. No. 554. Pisé-de-Terre, by P. B. Aird.
4/26. No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.
8/26. No. 605. Flue-curing Tobacco Barns. Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
5/27. No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
11/27. No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16ft., by B. G. Gundry.
10/32. No. 863. Piggeries, by B. G. Gundry, A.I.Mech.E.

5/33. No. 889. The Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.
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12/33. No. 908. A Charcoal Safe or Cooler, by B. G. Gundry, A.I.Mech.E., Irrigation Division.
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7/34. No 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.
8/36. No. 996. The "Gundry" Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.

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7/32. No. 858. The Softening of Waters, by the Division of Chemistry.
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9/34. No. 930. Analyses of Rhodesian Foodstuffs, by The Division of Chemistry.
4/35. No. 949. Report of the Branch of Chemistry for year ending 31st December, 1934, by A. D. Husband, F.I.C., Chief Chemist.
5/35. No. 954. Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts, by J. K. Chorley, F.R.E.S., and R. McChlery, B.A., B.Sc.
4/36. No. 983. Annual Report of the Branch of Chemistry for year ending 31st December, 1935, by A. D. Husband, F.I.C., Chief Chemist.

MISCELLANEOUS.

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4/28. No. 687. The Use of Explosives on the Farm, by P. H. Haviland, B.Sc. (Eng.).
7/28. No. 702. Book-keeping on the Farm, by T. J. Needham, Acting Accountant, Agricultural and Veterinary Departments.

9/28. No. 707. Wood-Charcoal in Southern Rhodesia, by T. L. Wilkinson, B.Sc., Assistant Forest Officer.

5/31. No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

6/31. No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.

3/32. No. 849. The Preservation of Farm Beacons, by L. M. McBean, Acting Surveyor-General.
How to Make Use of the Fencing Law.
Twelve Simple Rules for the Avoidance of Malaria and Blackwater.
Summary of the Game Laws of Southern Rhodesia.

9/34. No. 931. Chacoal-Gas as Fuel for Farm Tractors, by W. F. Collins, Assoc.R.S.M., "Riverside," Marandellas.

11/34. No. 935. The Weeds and Poisonous Plants of Southern Rhodesia, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture. Part I.

5/35. No. 953. A Scraper for Levelling Land, by D. E. A. Gutsche, Field Husbandry Officer, Kakamas.

6/35. No. 958. A Cheap Levelling Device, by A. W. Laurie, Howick Vale, Concession.

8/35. No. 961. A Home-made Ridger. Contributed by Mr. Douglas Aylen, Somerset, Concession.

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2/36. No. 979. The Prospects of Black Bass in the Inland Waters of Southern Rhodesia. Specially contributed.

6/36. No. 991. Silage and Silos.

8/36. No. 995. Cotton Marketing, by Th. G. Hesse.

8/36. No. 997. Reward Wheat: Report on the Baking Properties and Chemical Analyses, by The Rhodesian Milling and Manufacturing Co., Ltd.

8/36. No. 998. Summary of the Game Laws of Southern Rhodesia.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Referendum Egg Marketing Bill.—In this issue we are reprinting for the purpose of a referendum a memorandum and draft Bill which appeared in this *Journal* in September last. It will be noted that the suggested Bill is intended to secure the more orderly marketing of eggs. When previously published all those interested in the production and marketing of eggs were asked to give this question their careful consideration. It is not the intention of the Government to introduce the Bill unless the majority of egg producers throughout the Colony are in favour of this being done. Voting will be limited to farmers owning 50 or more fowls and a circular together with the draft Bill has been sent to all persons

recorded as being eligible at the Government Statistician's office. Should any poultry farmers falling in this category not have received a copy they should apply immediately to the Government Statistician, Box 791, Salisbury. Replies to three questions must be sent on or before 15th October, 1936, to the Government Statistician, for which purpose an addressed envelope has been sent out, on which postage is not payable for its return. The questions to which a simple answer Yes or No is required are as follows:—

1. Are you in favour of the introduction of the suggested Egg Marketing Bill?
2. If not, do you consider any other form of control should be established governing the marketing of eggs?
3. Are you of the opinion that the marketing of eggs should be left free and uncontrolled?

Soil Fertility.—From a scientific standpoint it is probably correct to say that even the best soils known are not perfectly fertile because so many different factors are involved in securing absolutely perfect soil conditions for any crop. It may be stated that a fertile soil has the following characteristics:—

1. It is suitable in texture and sufficiently deep to allow maximum root development within the normal period for the crop. Further, it is not restricted in depth by hard-pan or other impervious layer.

2. It absorbs the maximum rainfall of the region without becoming waterlogged, and retains sufficient moisture to enable the growing crop to draw its requirements with unfailing regularity.

3. It is sufficiently open in character that, even when fully charged with water there is sufficient air for the root-hairs to function properly.

4. It has a sufficient amount of organic matter to maintain the essential soil flora and fauna of fungi, bacteria and protozoa to meet the requirements of the crops concerned.

5. It has a suitable temperature to hold the balance between water supply evaporation and transpiration and to maintain the soil organisms in a most active state.

6. It contains sufficient plant foods to maintain optimum growth and possesses sufficient soil organisms and chemical activity to balance food supplies with the plants' requirements.

7. It is not too acid nor too alkaline in its reaction and it does not contain any harmful substance, such as excess of magnesia, arsenic, etc.

Tobacco Nematode.—In dealing with tobacco diseases met with while investigating the tobacco-growing industry in the United States of America, Mr. L. F. Mandelson, Plant Pathologist to the Queensland Department of Agriculture, refers to nematode as follows:—

The root knot nematode (*Heterodera marioni*) is most destructive at relatively high temperatures in light soils, and consequently is a serious factor in the production of flue-cured and cigar tobaccos in the Southern States. A special resolution of the recently formed "Tobacco Disease Council" indicated "that nematodes constitute the biggest plant problem in the South, and urges that more intensive study of nematode problems be conducted, and that it be carried out on a co-ordinated basis as far as possible." As indicative of the importance of the nematode problem in general, the United States Department of Agriculture maintains a special Division of Nematology, with a staff of approximately twenty research workers and two field stations. Investigations are also being carried out by the Division of Tobacco and Plant Physiology, as well as by various State Agricultural Experiment Stations.

Root knot is not a problem on the heavier tobacco soils or in the more northern States where seasonal conditions are cooler and soils are heavier. It does, however, frequently cause serious losses in the South, although, apparently, in 1935 the weather experienced was not conducive to severe infestation, and the damage observed was not as extensive as

usual. An additional factor involved in the control of nematodes in the cigar wrapper district of Florida is the high cost of the artificial shade tents under which this class of tobacco is grown, and which, consequently, makes control by rotations very expensive. Frequently commercial "shades" can only be successfully used for tobacco cultivation for two years owing to root knot. Nevertheless, is has been demonstrated at the North Florida Experiment Station that it is possible to grow tobacco on the same land continuously for thirteen years with success. The method adopted there is to maintain a thoroughly bare fallow for the ten months of the year that tobacco is not in the field. The time of planting is an important factor in regard to the degree of nematode infestation. When plants are set out late in the season high temperatures stimulate nematode activity, and consequently such plants are more seriously affected than earlier plantings. Nematode damage is most serious if plants are infested when they are young. Growers are advised to encourage the rapid growth of the crop in order to mitigate nematode injury.

Tobacco Mosaic Virus in the Soil.— Greenhouse and laboratory experiments were conducted recently by the Wisconsin Experiment Station in co-operation with the U.S.D.A. Bureau of Plant Industry to determine the relative importance of various factors to the persistence or inactivation of Tobacco Virus 1 in the soil. Since the virus leached out readily into the soil, the experiments were performed chiefly with virus extracts added directly to representative soils from different tobacco districts in the United States.

In certain soils immediate inactivation of an appreciable amount of the added virus occurred, but in no case to the high degree attained with such highly absorptive substances as charcoal. This limited inactivation was apparently not correlated with the physical character of the soil in the presence of moisture, but desiccation of the soil resulted in an immediate, and usually complete, inactivation. The rate and degree of inactivation during drying was correlated to a considerable degree with the soil character and is possibly related to absorption phenomena. Neither the degree of water satura-

tion above a low minimum nor the natural pH range in soils appeared to affect the inactivation, but aeration evidently increased its rate slowly both directly and through its effect on microbial activity. Soil temperatures of from 5° to 30° C did not appreciably affect the rate, but at 40° it was definitely increased.

Frenching of Tobacco.—E. L. Spencer, in a recent article in *Phytopathology*, records the results of a comprehensive series of experiments concerning the condition in tobacco known as Frenching. He found that it developed in only 7 of the 19 species of *Nicotiana* tested. Of 10 other solanaceous species tested, only *Petunia hybrida, Datura stramonium* and tomato were affected. Of the 16 nonsolanaceous species tested, none produced chlorosis characteristic of frenching.

The disease was controlled in the greenhouse by soil composting, by the addition of peat moss, by repeated applications of nitrogenous fertiliser, and by several applications of a dilute solution of $CuSo_4$ or $Al_2(SO_4)_3$.

No association of frenching with any pathogenic organism or any mineral deficiency was found. It was produced in tobacco plants grown in sand by the addition, at daily intervals, of an aqueous extract of toxic field soil or by adding as little as 1 part of field soil to 2,000 parts of sand. The experimental evidence presented indicates that frenching is probably not a mineral deficiency disease, but rather a disease produced by some toxic principle, present in certain soils, that exerts its action only under definite environmental conditions.

R.A.U. Congress.—The thirty-fourth annual Congress of the Rhodesia Agricultural Union meets in Salisbury on the sixth of this month. The agenda is fairly large, but the most important item is undoubtedly the consideration of the statement of agricultural policy which has been prepared by the Executive Committee of the Rhodesia Agricultural Union. All associations have been asked to examine the proposals carefully before the Congress so that any additions or alterations

can be made and the policy may be fully stated and transmitted to the Government with the unanimous blessing of the Congress. As was recently stated in an editorial of *The Countryside*:—

"The Government and members of Parliament have complained repeatedly of the difficulty experienced in ascertaining the views of the majority of farmers upon the measures which are introduced for the benefit of the industry. On more than one occasion a measure vehemently sponsored by authoritative representatives of the farmers has barely passed the House before equally vehement objections have been lodged. While it is the duty of the Government to carry through, regardless of the consequences, such measures as they believe to be in the best interests of agriculture it usually happens in practice that there are various alternative schemes which would achieve the desired end. It is therefore of great importance that those directly affected, the farmers themselves, should make up their minds prior to the introduction of legislation upon any material points in the issue. If this is not done, those who are conscientiously doing their best to formulate plans for the assistance of the industry cannot be blamed if the schemes proposed do not in every respect fulfil the farmers' demands. Even if the outline of policy suggested by the Executive is adopted by Congress only the first step in the right direction will have been taken. The translation of the principles laid down into practical legislation which will be generally acceptable must entail much hard thinking, and the elimination of many petty differences of opinion which at present exist. It is therefore the duty of Congress and the various farming organisations not to be content merely with the expression of general principles but to indicate as clearly as possible the broad lines upon which they consider these principles can be most appropriately carried into effect."

Livestock Policy.—The following statement was made by the Rt. Hon. Walter Elliot, M.P., M.C., F.R.S., Minister of Agriculture and Fisheries, on Monday, July 6, 1936, in reply to a question in the House of Commons by the leader of the Opposition, Mr. C. R. Attlee, M.P.:—

I can now indicate in broad outline the Government's permanent proposals for safeguarding the livestock industry. I must apologise for the length of the statement, but it is of interest and importance not only to this House but to producers both at home and overseas.

The Government propose to proceed on the basis of a regulated market with the maximum supplies for the consumer consistent with a reasonable level of remuneration for the producer.

It is the Government's desire that, at the earliest possible date, the responsibility for securing stable market conditions should be assumed by producers in the various countries concerned and exercised in the light of joint discussion of the problems involved.

This discussion would be secured by the institution of an Empire Meat Council, representative of the United Kingdom and other Empire countries concerned, and an International Meat Conference, representative of the United Kingdom, other Empire countries and the foreign countries supplying substantial quantities of meat to this market.

It would be proposed that, unless agreed otherwise by the Conference, aggregate exports to this market of beef (frozen and chilled and the meat equivalent of fat cattle) during each of the next three years should not exceed recent levels.

Further proposals as to market regulation, which mainly affect the exporting countries, are under discussion with the Governments of the countries concerned. Full details will be given in due course.

The Government have given earnest consideration to the position of the United Kingdom cattle producer under these arrangements, and they propose to invite Parliament to make provision for a permanent scheme for the payment from the Exchequer of a subsidy to prdoucers of fat cattle in the United Kingdom which, while not stimulating an artificial expansion of the home industry, will continue for so long as and to the extent that the situation may require.

As the House will be aware, my Rt. Hon. Friend the President of the Board of Trade is at present in negotiation with the Argentine Government on the terms of a Trade Agreement to take the place of that now in force. I cannot forecast the terms of any settlement that may be reached, but I am able to say that in any event Parliament will be invited, immediately after the summer recess, to pass legislation providing for the collection of Customs duties on imports of chilled, frozen and other descriptions of beef and veal from foreign countries. The revenue derived from these duties will accrue directly to the Exchequer. It is not proposed, as part of the arrangements in contemplation, that there should be duties on imports of beef from Empire countries or on imports of mutton and lamb from any country.

The Government are of opinion that if adequate provision is to be made in one form or another for the needs of the United Kingdom cattle industry, the aggregate financial assistance now given to it must be increased until such time as the conditions prevailing in the industry improve. They propose to seek the authority of Parliament to apply to the assistance of the industry such sums not exceeding £5 million per annum as may from time to time be needed. Parliament will be asked annually to make provision for a sum not exceeding this amount. As an offset to this liability, the Exchequer will benefit to the extent of the revenue from the import duties to which I have referred.

The Government are desirous of providing that the payments made to the home producer of fat cattle under the permanent scheme shall be so adjusted as to give further encouragement to quality production. No final decision has been reached as to the measures to be taken to this end, but the Cattle Committee, which administers the present temporary subsidy, have for some time had the practical aspects under consideration and will now consult with the various interests concerned.

As regards mutton and lamb, imports of which are at present regulated in the case of foreign imports under statute, and in the case of Dominion imports by voluntary arrangements, the Government propose to continue the present system for the year 1937. The question will fall for considera-

tion in due course whether thereafter the International Meat Conference, in association with the Empire Meat Council, should operate in regard to exports of mutton and lamb to this market.

The Government hope that the arrangements they contemplate for the stabilisation of the meat market will work to the satisfaction of all interests concerned, but as a precauionary measure they will ask Parliament to give them general powers to regulate imports of livestock and meat should the need arise.

The House will be invited to pass, before rising for the summer recess, a short interim measure extending, without modification, the existing cattle subsidy arrangements until, if necessary, July 31, 1937, and legislation to give effect to the permanent proposals, including measures for the encouragement and promotion of efficiency, will be placed before Parliament early next session.

The Raising of Bacon Pigs.

By A. E. Romyn, Chief Animal Husbandry Officer, and
C. A. Murray, Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate,
with a Veterinary Section by D. A. Lawrence, Director of Veterinary Research.

Introduction.—It seems necessary these days to preface any article on pigs with a statement as to the economic position of the industry.

The pig industry in Southern Rhodesia has not grown to any great extent during the last few years. This lack of progress is due chiefly to the limited character of the local market which, in the absence of an organised export trade, is easily over-supplied. Periods of over-supply have occurred at regular intervals during the last decade, and the resultant low prices at each of these periods have discouraged production and prevented permanent growth in the industry. The relative stagnation in numbers is plain from the following figures:

Number of Pigs in Southern Rhodesia.

Year.	Owned by Europeans.	Owned by Natives.	Total.
1924	20,446	29,480	49,926
1925	20,156	35,437	55,503
1926	20,385	35,932	56,317
1927	19,981	35,714	55,695
1928	21,102	47,350	68,452
1929	23,490	37,889	61,379
1930	25,536	40,946	66,482
1931	22,085	45,795	67,880
1932	23,260	52,276	75,533
1933	23,591	55,585	79,176
1934	25,312	64,153	89,465

Southern Rhodesia is well suited to the raising of pigs, and records of the industry show that during the last decade the consistent pig farmer has made profits from pig keeping which compare favourably with other agricultural enterprises. There is no reason why this type of farmer should not continue to make similar profits in the future, despite the limited nature of the local market.

It is not generally realised, however, that there will not be a stable market for pigs until an export trade is developed, and as veterinary restrictions on export have recently made it difficult to find an outlet in adjoining territories for the local surplus, attempts are now being made to develop an export trade in frozen porkers and baconers with the United Kingdom.

There are difficulties ahead, but the early results are promising. The success of the export trade will, however, depend upon the ability of the producers to meet the requirements of the English market and on their success in reducing production costs. The efficient producer should be able to do both.

THE BACONER.

The Type of Pig Required.—Certain parts of a bacon side are more in demand and have a higher value than other parts. The valuable parts are the middle and the hams. The fore end is of much less value.

The desired type of pig is one which has the maximum development in the valuable parts, and should have the following characteristics:—

(*a*) *Conformation.*—Great length between the shoulder and ham. The back should be slightly arched and be of medium and uniform width from rump to shoulder. The sides should not be too deep, but of uniform depth from chest to flank. The shoulder should be as light and fine as possible, showing no signs of coarseness and blending smoothly with the sides. The finer and lighter the jowl and neck the better, as these parts have relatively little value. The hams should be well developed, broad, plump and well let down to the hocks. There is a tendency here to neglect the development of the

ham owing to the difficulty of disposing profitably of hams on the local market. A deficiency on the ham is, however, a serious weakness in the export pig. The underline should be firm, full and show no signs of flabbiness.

A baconer should give one the impression of a long, lean, well-fleshed pig showing no excessive tendency to lay on fat. The short, broad, deep, lard type of pig should be avoided altogether. Figure 1 illustrates the correct type.

(*b*) *Quality.*—It is of importance that the baconer should show quality and thriftiness. A thin, smooth skin and fine covering of hair indicate these. Any sign of coarseness, such as is found in a heavy shoulder, wrinkled skin and rough hair, is most undesirable.

(*c*) *Finish.*—When marketed the baconer should be well finished, *i.e.*, the back, sides and underline should be well filled and have a smooth and full appearance. The back fat of an unfinished pig is generally too thin and soft, and the whole carcase has a flabby appearance. The over-finished pig, on the other hand, is too fat for the production of the best quality bacon.

(*d*) *Correct Weight.*—The weight at which to market a bacon pig depends on the type of pig. The longer the pig, the heavier is the weight to which it has to be fed to secure a proper finish. The shorter the pig, the lighter is the weight at which it can be marketed.

The correct weight is also influenced by the ration. Pigs fed largely on maize are ready for market at lighter weights than pigs that have been fed on well balanced rations.

A liveweight of approximately 200 lbs. is generally taken as the standard for the Large White or Tamworth x Large Black cross when properly fed. The local market favours lighter weights at present but it is likely that, as the general type and feeding of the pigs improve, the present popular weights of 170-180 lbs. will gradually increase to the 200 lbs. figure.

It requires careful judgment to determine the correct degree of finish for marketing.

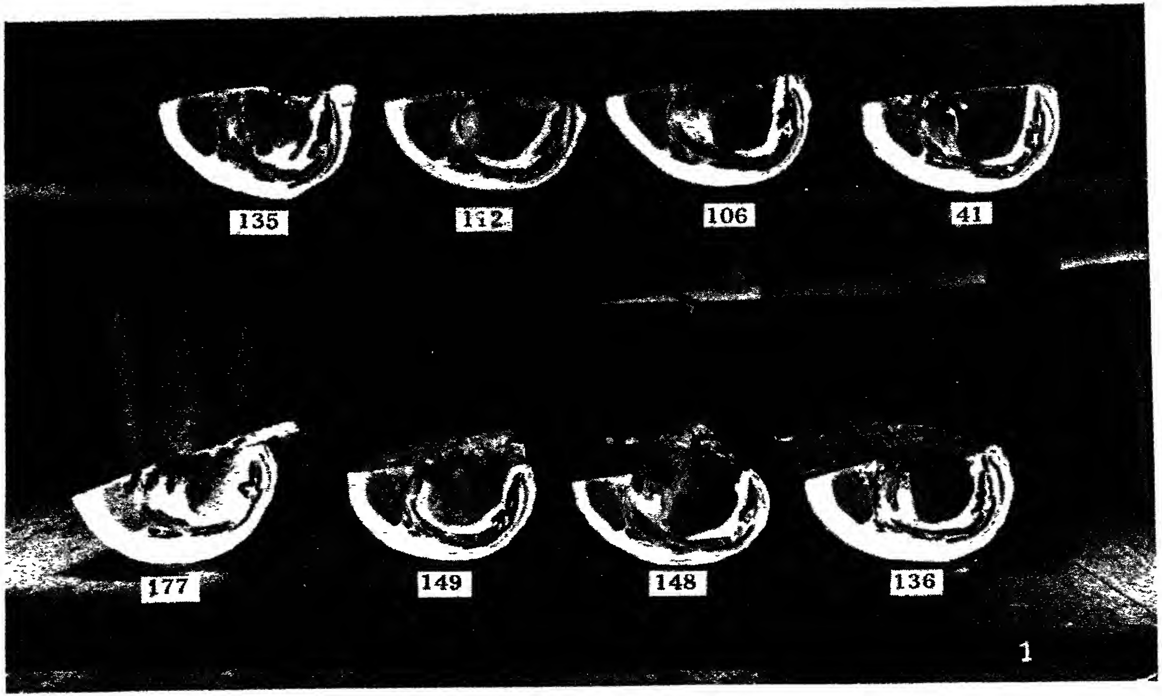


Fig. 3. Pig No. 112 shows excellent cutting qualities.

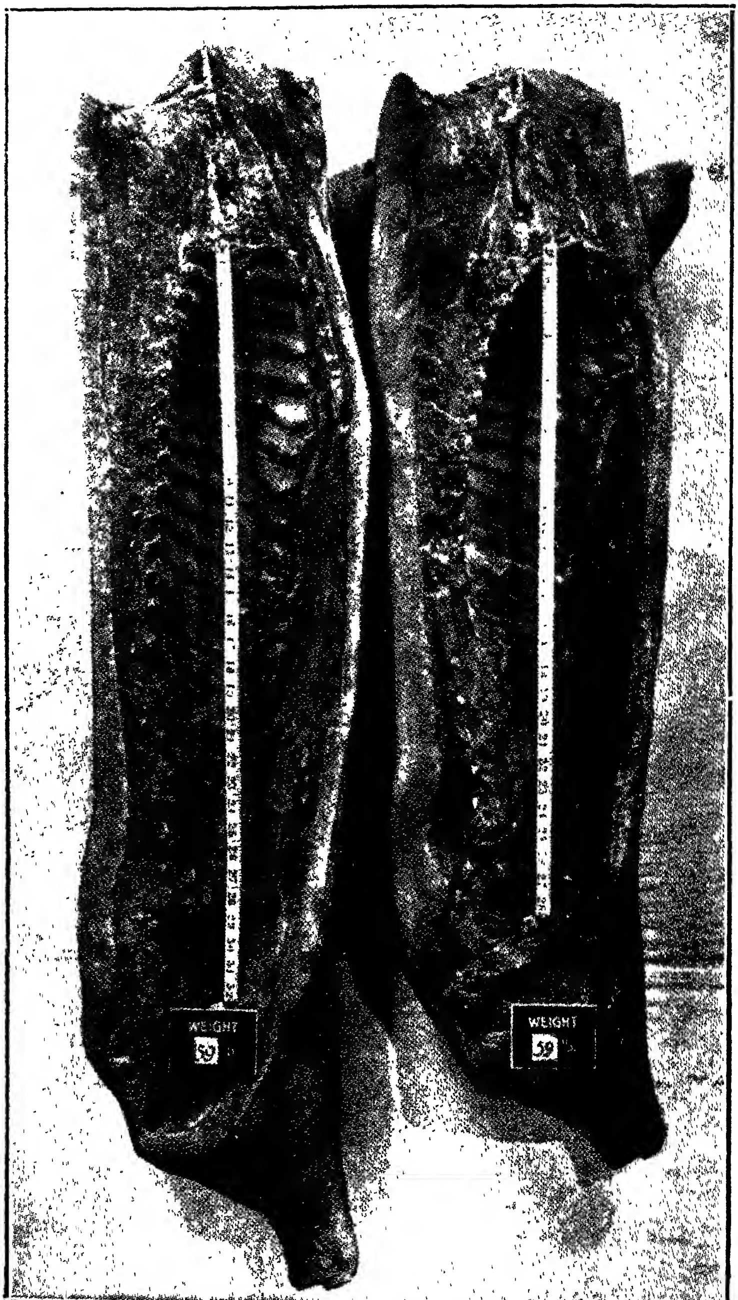
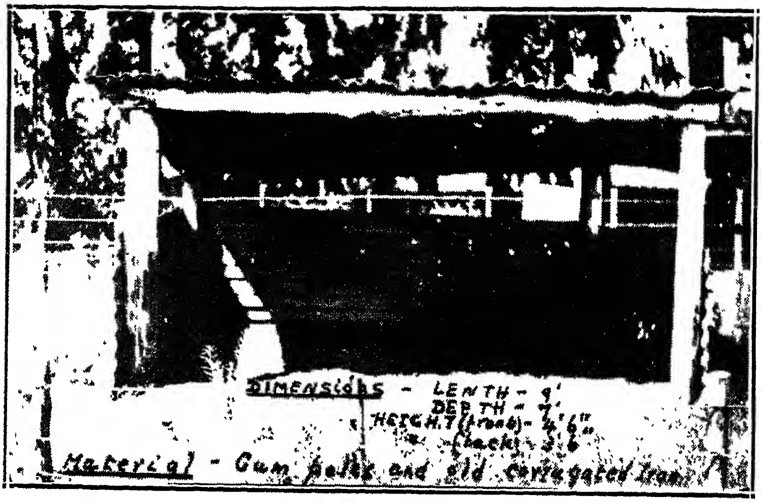


Fig. 2. Desirable and undesirable sides of the same weight. The shorter side is over-fat and is too heavy in the fore end.
(From Economic Report No. 17, Ministry of Agriculture and Fisheries.)



A simple colony house.

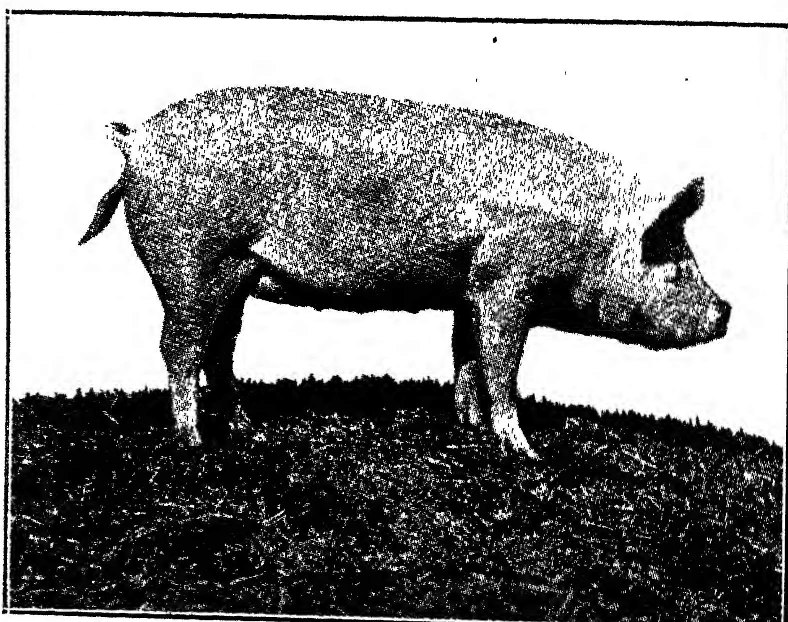


Fig. 1. A select Baconer.
(From Pamphlet No. 40. Canadian Department of Agriculture.)

The Type of Bacon Carcase Required.—After the pig has been killed, bled, scalded, scraped and singed, the entrails, heart and liver and lungs are removed. The carcase then is weighed to obtain the dressed weight of the pig. This weight should be from 75 per cent. to 80 per cent. of its weight before slaughter. The carcase is then split and the backbone, head, tail, leaf fat, tenderloin, kidney fat and kidneys are removed. The two sides are now separate, and it is not until this stage that a reliable judgment can be made as to the suitability of the pig for bacon production. Figure 2 shows desirable and undesirable bacon carcases.

The side should have an even covering of back fat, not exceeding 2 inches over the shoulder and tapering slightly from shoulder to ham. An uneven layer of too thick or too thin back fat is a very serious fault. The belly and flank should also be thick and full of substance and not less than 1¼ inches thick. There should be no signs of seedy cut (see next section), and the side should show no signs of bruises, boils, spots or cuts.

The Type of Pork Carcase Required.—The local market tends at present to favour a comparatively light porker but, as the market becomes more descriminating, the tendency will be to breed up to "standard porker," which should weigh from 100-115 lbs. live weight.

The ideal porker should be under five months of age. It should be well finished and smooth; comparatively light in the shoulder; with firm, slightly arched back and well sprung ribs. The hams should be plump and well let down.

A good proportion of lean meat in the carcase in proportion to the fat is very important. This proportion is influenced by both breed and feeding.

Figure 3 shows a number of different types of porker carcases cut through at the last rib. The right proportion of lean to fat is shown by pig No. 112. An excessive amount of fat in relation to the amount of lean is shown by pigs 136 and 177 in the same figure.

The following are some common carcase defects in baconers. In most cases they apply to porkers as well.

(*a*) *Deficient Length.*—Not only is it desirable to have a long middle because of the relatively high value of the bacon obtained from it, but a short pig usually has other undesirable features, such as too much fat and heavy shoulders.

(*b*) *Back Fat too Thick or too Thin, or Uneven.*—These faults are among the most serious that a bacon carcase can have. At present the demand is for lean bacon, and too much fat is seriously discriminated against. An unfinished carcase, on the other hand, with too thin back fat, produces a soft, flabby side unsuitable for bacon production.

The desirable depth of back fat will vary with the weight of the pig.

The standard laid for the C (average) grade of pig by the Pig Marketing Board in the United Kingdom allows for a maximum depth of back fat of 2 inches and a minimum belly thickness of 1¼ inches for a pig dressing out 140-170 lbs.

(*c*) *Heavy Shoulders.*—This part of the carcase has the lowest value per pound. A heavy shoulder is also generally associated with two other serious defects, *viz.*, deficient length and too much fat.

(*d*) *Thin Bellies.*—These are undesirable, because of the flabby appearance they give to the carcase and the unsatisfactory rashers that are cut from them. Unfinished, badly bred and unthrifty pigs usually suffer from this defect.

(*e*) *Soft Fat.*—A soft carcase soon goes rancid. It has an oily and flabby appearance, and is most undesirable. Unthrifty, slow maturing, unfinished pigs generally have soft fat. The feeding of ground nuts, soya beans and sunflower seed produce the same effect. Early maturing, thrifty, well-finished pigs are generally firm.

(*f*) *Seedy Cut,* found in the belly fat of pigs, is due to an infiltration of the skin pigment, and has a speckled appearance resembling small seeds. It is only visible in black pigs. Although in no way harmful, the discolouration spoils the appearance of the bacon and often results in the cutting out of large pieces of belly bacon to be used for rendering into lard.

Fig 5. Large Black Sow

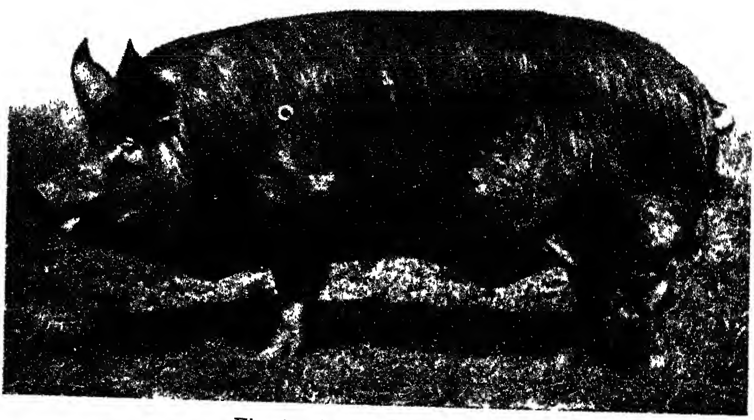


Fig. 7. Tamworth Boar.

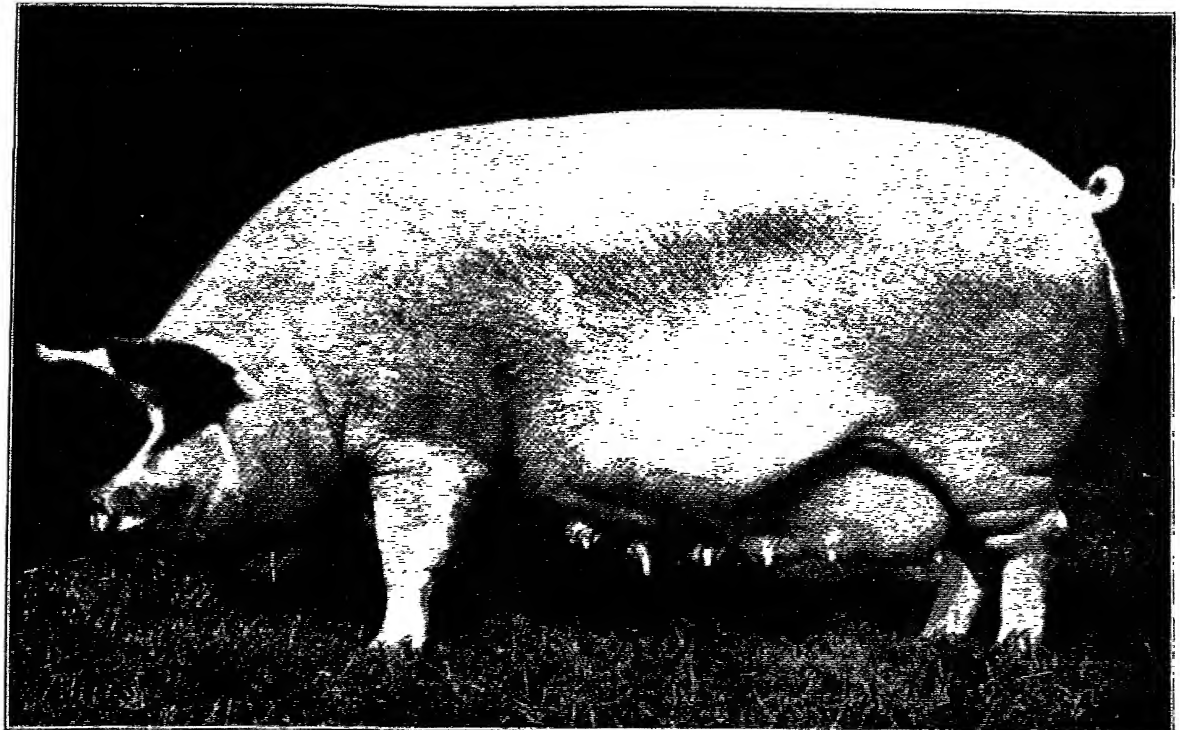


Fig. 6. Large White Sow.

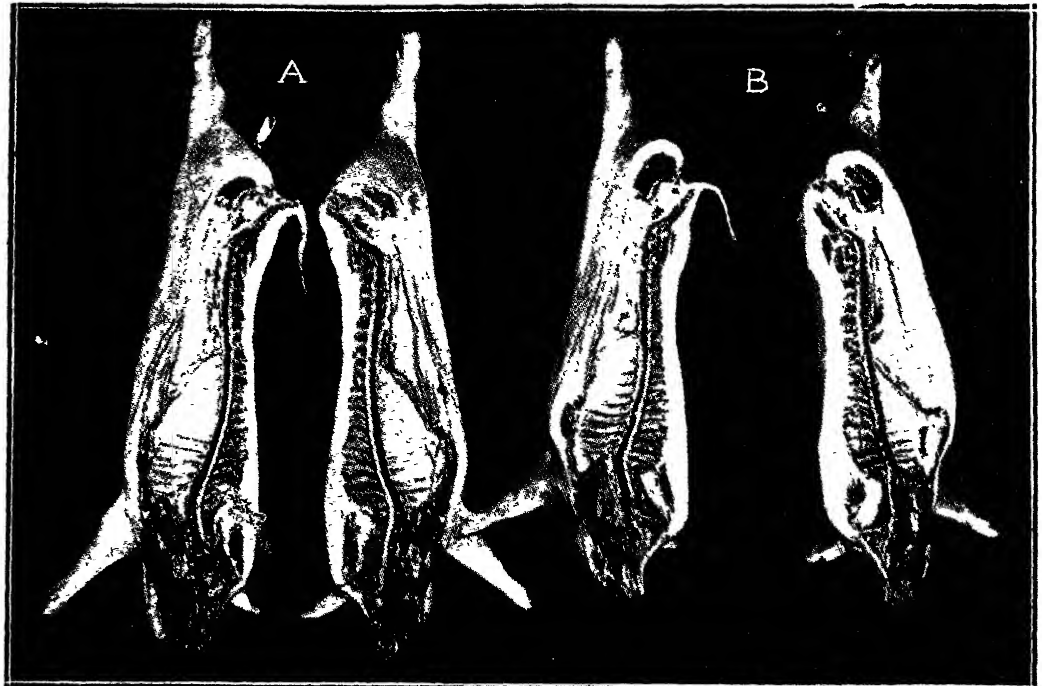


Fig. IV. A. A desirable carcase with good length.
B. An undesirable carcase, short and too fat.
(From Economic Report No. 17, Ministry of Agriculture and Fisheries.)

(*g*) *Meat of Poor Quality.*—Some breeds or crosses produce coarse meat. The lean meat of an unfinished pig will usually be poorly marbled. Good quality meat is well marbled, light in colour and has a fine grain. Black pigs have darker coloured meat than white pigs. Generally, well bred and well fed pigs have good quality lean meat.

(*h*) *Blemishes.*—Bruises, boils, cuts or spots on the carcase constitute blemishes and detract greatly from its appearance and value. Rough handling is the usual cause of blemishes.

FACTORS WHICH INFLUENCE THE VALUE OF A PIG FOR BACON AND PORK PRODUCTION.

(1) **Breeding.**—Certain types and breeds of pigs are unsuitable for production of lean, sizeable bacon. They may be too fat, too heavy in the jowl or shoulder, too thin in the belly or too light in the hams. Such types or breeds should not be used for bacon production. Even in the typical bacon breeds—Large White and Tamworths—we often find sows which produce pigs that are "off-type" and unsuitable for bacon production. Figure 4 shows desirable and undesirable sides. Boars and sows which produce such pigs should be culled immediately from the breeding herd.

The most common breeds in the Colony at present are the Large Black and the Large White. A few Tamworths are maintained, and it is thought that the numbers of this breed will increase in areas where white pigs do not appear to thrive as well as dark pigs.

Typical specimens of these breeds are shown in figures 5, 6 and 7.

The Large White is the leading bacon sire in the bacon producing countries in the world to-day. The Large Black is favoured in this Colony on account of its hardiness, good motherhood and proficiency. It is the commonest breed at present and the easiest one in which to purchase female breeding stock.

The commercial baconer and porker is usually a first cross, the cross recommended by the Department being that of the Large White boar with the Large Black sow. Where white

pigs are not satisfactory the Tamworth boar can be used in place of the Large White boar. Both these crosses serve the dual purpose of producing a pig suitable for either the baconer or porker trade, depending on how it is finished. The thicker pigs can be forced after weaning and marketed as porkers. The longer and leaner pigs can be carried on to bacon weights. The former cross is preferred by the market on account of its white skin.

Berkshires or Middle Whites of the type bred in this country, either pure or crossed with any other breed or type, are generally unsuitable because of their excessive fat, deficient length of side and heavy shoulders. The breeding of Berkshires or Middle Whites or their crosses for bacon production is therefore not recommended.

The pure Large Black is generally unsuitable for bacon production on account of its tendency to produce coarse flesh and inferior bacon conformation. The Large Black sow is, however, retained for crossing with the Large White and Tamworth boars on account of its availability and its hardy, prolific and motherly qualities.

Feeding and Management.—"Feeding" and "management" are as important as "breeding" in the production of the right type of baconers and a well bred baconer, if wrongly fed and managed, will not develop into a good pig, although it may have the inherent ability to do so. Wrong feeding and management may result in soft fat, too thick or too thin and uneven back fat, slow maturity, expensive gains, poor quality meat, stunted, unthrifty, and poor type pigs.

Common Errors in Feeding and Management.—The following practices should be guarded against:—

(*a*) *Under-feeding and the use of Unbalanced Rations.*—These result in slow growing, stunted, unthrifty pigs that make expensive gains. Bad feeding may cause the fat to be soft and the carcase to be of poor quality. Usually the faster the pig grows the cheaper it is to produce and the better the quality of its meat.

(*b*) *Incorrect Finish.*—An unfinished pig is undesirable, and usually produces a flabby carcase with soft fat, a thin

belly and poor quality meat. It is of importance to feed the pig until it has the correct finish without allowing it to get overfat.

(c) *The Use of Excessive Fattening or Oil-containing Feeds.*—Some feeds should not be used for bacon pigs. Kaffir corn has a tendency to produce too much fat. Ground nuts, soya beans and sunflowers produce soft, oily fat, and should not be fed to baconers.

(d) *Poor Housing, Bad Sanitation, etc.*—These all tend to impair the general health and well-being of the pig, and so prevent it from growing out economically or producing the quality of bacon which it is capable of doing under proper conditions.

THE BREEDING HERD.

Selection.—Particular attention should be paid to the selection of stock for the breeding herd, as on their suitability or otherwise will depend to a large extent the success of the business. The pigs selected should be typical of the breed, pure-bred, and, if possible, registered. Pure bred pigs are comparatively cheap and cross-bred or grade sows should not be used,.as they do not produce such uniform litters. Breeding stock should not be selected too young. The boar should not be chosen under six months or the gilts under three to four months of age. Even at these ages it is hardly possible to form an accurate estimate of their future development. It is important to select the breeding pigs from sows that are known to have produced and reared large uniform litters of the correct type.

The head, conformation, and carriage of the boar should show character and masculinity without being coarse. The sows should show femininity, character and no signs of masculinity. Both sexes should have good length, be relatively fine and light in the shoulder and jowl, strong in the back, with a slight arch from the shoulder to the rump. The ribs should be sufficiently well sprung to indicate constitution and the sides should be smooth, and blend well with the fore and hind-quarters. The hams should be full, well developed and well let down into the hocks. The legs should be short

and strong, and particular attention should be paid to the pasterns, which should be strong and straight. There should be evidence of quality throughout. Quality is indicated by a smooth, clean-cut appearance, a fine skin, fine silky hair, fine bones and light shoulders. A glossy coat is evidence of health and should be looked for.

The sow should be of quiet disposition, as a nervous and irritable sow often kills a large proportion of its progeny, and is seldom a good doer. The udder should be sound and there should be not less than six pairs of well-developed teats. In the gilt the teats should be well developed and not have the appearance of small "buttons." The boar should have the same number of rudimentary teats. Hard lumps in the udder and blind teats should be watched for in a mature sow.

The Breeding Age.—The best age at which to breed young gilts will depend on their development. Well-developed gilts, weighing 200 to 250 lbs. and over at eight months of age, can be put to the boar. A gilt bred too young or before it has developed sufficiently can only rear properly two or three piglets. This small number will not only affect her udder development, but will also greatly increase the cost of production of the young pigs. If such a gilt is allowed to rear larger litters the strain may permanently stunt its growth and spoil it as a breeder. On the other hand, some pure-bred breeders allow their gilts to grow too old and over-fat before breeding them. This is usually the case with show pigs, and it is an undesirable practice, because it increases the cost of the young pigs and may even cause temporary or permanent sterility in the sow. Gilts for the breeding herd should get plenty of exercise in order to develop a good frame.

Under average conditions it is unwise to use a boar until it is a year old. It should be used sparingly at first. Experience has shown that over-use of the boar pig will frequently injure its future breeding powers and result in small litters. A mature boar can breed up to 30-40 sows per year if the services are properly distributed. It is not wise to allow the boar to run with the sows unless the herd is small. If there is a big difference in the size of the boars and sows a breeding crate should be used to facilitate service.

The Gestation Period.—The usual period between successful service and farrowing is from 114 to 115 days, or about "three months, three weeks, three days." The following gestation table gives the date of farrowing for sows served on certain dates:—

Gestation or Breeding Table.

Date Served.	Date Due.	Date Served.	Date Due.
January 1.	April 25.	July 1.	October 23.
January 16.	May 10.	July 16.	November 7.
February 1.	May 26.	August 1.	November 23.
February 16.	June 11.	August 16.	December 8.
March 1.	June 23.	September 1.	December 24.
March 16	July 8.	September 16.	January 8.
April 1.	July 24.	October 1.	January 23.
April 16.	August 8.	October 16.	February 7.
May 1.	August 23.	November 1.	February 23.
May 16.	September 7.	November 16.	March 10.
June 1.	September 23.	December 1.	March 25.
		December 16.	April 9.

Breeding Season.—The sow, if properly fed, comes on heat every three weeks, unless she is pregnant or nursing a litter. The period between heats is about three weeks (21 days), although it often varies from 18 to 23 days. The "heat" usually lasts for three to four days, and as the ova are usually shed about 30 to 35 hours after the beginning of heat and do not retain their vitality for more than a few hours, the sow should be served during the first or second day of heat. Where market conditions are secure, it is usually the best practice to have all the sows farrow at more or less the same time. A sow on heat will show a swelling of the vulva and general excitement and will follow other females about. The condition of the boar and sow at service have an important effect on the number of young born. The sow should be in improving condition and the boar in a vigorous, active state.

Number of Litters per Year.—The more young pigs a sow produces and rears successfully per annum the lower will be the cost of production of the weaners. The object should be to get as many litters in as short a time as possible. To let a sow rear one litter and then "board" her for the rest of the

year is bad economy. The optimum to aim at is two litters per year. This number, however, will be a heavy drain on the sow and she should therefore be well fed and cared for while nursing and during pregnancy. To obtain two litters per annum the young must be weaned at eight weeks of age and the sow served when she comes on heat, four to six days after weaning.

Size of Litters.—Some sows will farrow up to and over 20 piglets at a time. A sow usually has 12 to 14 teats, and it is therefore of little use for her to farrow more than this number. In addition, the piglets in such large litters are usually weak at birth. The most profitable size of litter to rear will depend on the number of teats and the milk yield of the sow. Few sows can rear more than 10 thrifty pigs. Gilts, because of their lower milk yield, should not rear more than 6 or 7 with the first litter. To have a herd average of 8 or more thrifty pigs weaned is considered very satisfactory.

Weaning Age.—With good feeding and management the young pigs should be weaned at about 8 weeks of age, when, if they have been well done, they should weigh 35-40 lbs. A more common weight is, however, 25-30 lbs. Good weaning weights are indicative of good management and the higher the weaning weights the more profitable the pigs will be to feed.

Pigs intended for the breeding herd or those which have not done so well should usually be weaned later at 10-12 weeks of age.

The following weights can be taken as satisfactory at the different ages:—

8 weeks	...	25 lbs.	12 weeks	...	50 lbs.
16 weeks	...	80 lbs.	20 weeks	...	120 lbs.
24 weeks	...	160 lbs.	28 weeks	...	200 lbs.

Castration and Marking.—These operations should be performed at from 4 to 6 weeks of age and not a few days before or after weaning. For castration use clean, sterilised instruments, and put some disinfectant and fly repellent on the wound. At the same time the young pigs should be earmarked (by means of a clipper) according to some definite system. The key overleaf illustrates a satisfactory system.

	50			5	
30		10	1		3
	100			200	

One notch on the inside of the right ear indicates 1.

Two notches on the inside of the right ear indicates 2.

One notch on the outside of the right ear indicates 3.

One notch on the outside and one on the inside of the right ear indicates 4.

One notch at the tip of the right ear indicates 5.

One notch at the tip and one on the inside of the right ear indicates 6.

One notch at the tip and one on the outside of the left ear, and one notch on the outside and one on the inside of the right ear indicates 84, and so on.

With this system pigs can be marked from 1 up to 500 or over 600.

Pig Recording.—In progressive pig raising countries a system of pig recording rather similar in principle to the ordinary system of milk recording has come into use. Production and feed records are kept of all sows and their progeny, and carcase records are obtained when the baconers are slaughtered. By this means it is possible to determine which sows are the producers of large litters, which use their feed economically and turn out into satisfactory baconers. By breeding from these sows only the productivity and profitableness of the herd is much increased.

All pig farmers should maintain some system of pig recording. The subject is too large to treat here, but particulars of systems suitable for different sets of circumstances can be obtained from the Department of Agriculture.

THE FEED AND MANAGEMENT OF BACONERS AND PORKERS.

General.—Guesswork should have no place in the feeding of pigs. As much attention should be paid to the balancing of rations for pigs as to those for any other form of live stock.

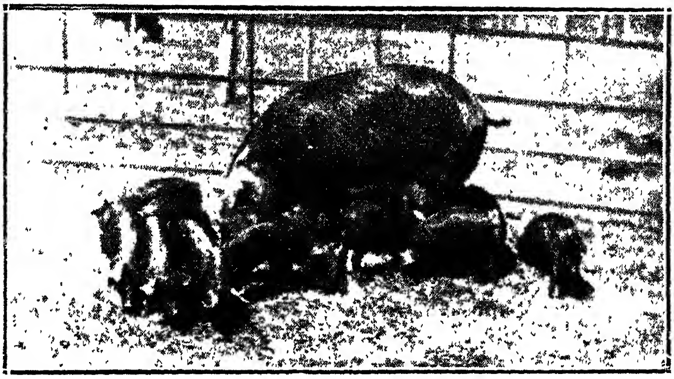
The quantity of feed used should be weighed and apportioned correctly, taking into account the size of the pigs and the degree of finish that they have reached. A weighing scale to determine the progress of fattening of growing pigs is as essential on a pig farm as a milk scale is to the owner of a dairy herd.

The pig is handicapped by the relatively small capacity of its digestive system. It cannot handle large quantities of bulky or fibrous feeds. In general, the ration for baconers should be concentrated and digestible, and the pigs should be pushed for the maximum rate of growth in keeping with the system of management in vogue. As a rule the pigs which make the largest daily gains in live weight are the most profitable to the feeder.

Under local conditions there is no grain feed as useful as maize. It is, however, relatively deficient in protein and mineral matter. Kaffir corn, nyouti, barley and oats have the same general characteristics and they can be used interchangeably with maize or as a substitute for part of the maize in the ration. When used as the sole grain they usually have less feeding value than maize, and the high fibre content of oats makes that feed unsatisfactory as a sole grain feed for baconers.

The best protein supplements for the common farm grains are separated milk, butter milk and meat or blood meal. Cow peas and ground nut cake are relatively high in protein, and can be used as substitutes for these animal by-products. They are generally, however, not quite as satisfactory, nor do they produce bacon of as good a quality. Ground nut cake has a tendency to produce soft bacon, and should not be used extensively for baconers. The wheat by-products, pollard and bran, are excellent supplements to replace part of the maize when available at prices comparable to maize.

Bulky crops such as roots, sweet potato tubers, melons and pumpkins should only be used in moderate amounts for fattening pigs. Usually not over 3-5 lbs. should be fed per head per day. In excess they are reported to cause watery meat and pot-bellied pigs.



A good producer.

Young pigs feeding in a creep.

The rate of gain will generally be increased by the provision of suitable pasture during the summer months, and by succulent or green feeds during the winter. These green feeds stimulate the appetite of the pig and provide vitamins which may be lacking in the grain ration.

To ensure a proper supply of minerals, the pigs should generally have free access to a mixture of bone meal 3 parts, salt 1 part. Three per cent. of this mixture should be mixed with the grain feed. Charcoal or wood ashes are generally beneficial to pigs in sties.

Results of Experiments.—The following results are quoted from Bulletin No. 162 (1936) of the Department of Agriculture and Forestry of the Union of South Africa.

"To gain information on the use of typical South African foodstuffs, a series of experiments has been carried out at the Schools of Agriculture, and these are summarised hereunder:—

(*a*) *A Standard Ration.*—It has been found difficult to secure both the desired uniformity in length and the required thinness and firmness of fat under prevailing conditions of feeding, in which maize constitutes the major part of the ration.

As a result of experiments completed to date, a ration consisting of maize meal 90 parts and meat meal 10 parts by weight, supplemented with 3 per cent. of a mineral mixture consisting of sterilised bone meal 3 parts and salt 1 part by weight, and a small daily allowance of green feed, has been adopted as the standard ration for bacon pigs. Although not ideal in many respects, this combination proved to be the most economical system in the Union. Pigs fed on this ration showed a tendency to become finished before the most desirable weight for baconers was reached. It is, therefore, not advisable to force the animals unduly, especially since our work indicates that forcing also may be responsible, to some extent, for the production of shorter pigs. In spite of this precaution some pigs will have to be marketed at weights considerably below the 200 lb. limit, although marketing at too low weights should be guarded against, since considerable evidence was obtained in some trials that low weights and

softness of fat were correlated. More definite evidence was obtained to the effect that an unfinished condition is invariably associated with softness of the fat, consequently care should be taken that all baconers are properly finished.

As regards the effect of this ration on the length of the pigs, the results are somewhat contradictory, but it is fairly certain that the ration exercises only seconadry influence in this respect, and that breeding is the major factor determining the length of side. It was observed, however, that in several instances forcing the pigs on the maize meal-meat meal ration appeared to be conducive to the production of relative short and over-fat sides.

The effect of this ration on the firmness of the fat leaves something to be desired. The meat meal, of course, produced a pronounced hardening effect, but it will seldom be possible to procure one hundred per cent. of firm carcases, and a small percentage of soft carcases can always be expected, especially if no separated milk is fed. This condition could be further improved, however, by increasing the proportion of meat meal, but on the basis of relative prices it is doubtful whether this course would prove profitable to the producer.

(*b*) *A Maize and Barley Ration.*—When 50 per cent. of the maize meal in the standard ration described above was replaced with an equal weight of barley (*i.e.*, maize meal 45, barley 45, meat meal 10 parts by weight) a most suitable ration for the production of lean sizeable bacon was obtained The addition of barley resulted in the production of a larger percentage of firmer sides, but the length of side produced remained unaffected. Further, increasing the proportion of barley showed no additional effect on either the texture of fat or length of carcass. Although this ration showed a distinct advantage over the standard one, the local production of barley is relatively small as compared with that of maize, with the result that the market value of barley is proportionately higher, consequently the use of a large proportion of barley in the ration was found to increase production costs materially.

(*c*) *A Maize and 'nYati Ration.*—The results of a feeding trial indicate that 'nYati may be substituted for barley in the 45:45:10 ration. The pigs on this ration made phenomenal gains, averaging well over 1.5 lbs. daily. They grew well and showed no tendency to become overfat. The quality of the carcases was excellent, and tests are now being conducted to determine the effect of this ration on the firmness of the fat. The results of overseas investigations indicate, however, that 'nYati in the ration of baconers exercises a favourable influence on the firmness of the fat equal to that of barley.

(*d*) *Maize and Separated Milk.*—In the trials in which maize formed the sole grain in the ration, but supplemented with a liberal allowance of separated milk (up to 2 gallons daily per pig) quite satisfactory results were obtained, and it is considered that in localities where an abundance of separated milk is available, this ration would prove more economical than the standard, especially when the pigs have access to pasture.

(*e*) *Maize and Kaffir Corn Ration.*—In a few trials part of the maize meal in the standard ration was replaced by Kaffir corn, with unsatisfactory results, inasmuch as the pigs showed a tendency to produce stout and over-fat carcases, although the Kaffir corn appeared to exercise a hardening influence on the texture of the fat.

(*h*) *Reducing the Protein.*—An attempt was made to reduce by 50 per cent. the proportion of meat meal in the standard ration. Although good gains were made by the pigs on this ration, the quality of the bacon was undesirable in that the marbling was poor. Furthermore, the pigs reached marketable condition at low weights, and consequently showed a tendency to produce soft carcases in addition to a high percentage of No. 2 lean sizeable sides. No reduction in the proportion of meat meal is recommended at this stage of our knowledge.

In fact, there is reason to believe that the protein content of the rations at present fed to pigs could be increased with advantage."

FEEDS AND FEEDING.

Preparation of Feed.—The grinding of maize results in a saving of about 5 per cent. of the feed. In the case of pigs under 150 lbs. live weight, the economy effected is somewhat less. Small grains such as Kaffir corn, barley and oats should be ground for pigs. All meals should be fed as a slop. The cooking of the common feeds, except potatoes and beans. decreases their value for pigs. Separated milk should be fed either always sour or always sweet. Usually it is safer to feed it sour. Whey should be fed sweet. Butter milk has of necessity to be fed sour. Cleanliness is especially important with dairy by-products.

Methods of Feeding.—Pigs may be fed in dry lots, in sties or on pasture. The pasture system is little used in Southern Rhodesia. The dry lot, or camp, commonly takes the place of the pasture used in other temperate countries. The lack of good pastures is unfortunate as, where suitable pastures are available, pigs will usually make more rapid and more economical gains during the summer by this method than by any other. The dry lot, moreover, unless the camps are frequently changed, is unsatisfactory and frequently becomes a source of worm infection for the pigs. When proper pastures or camps are not available, it is probably advisable to keep the baconers in sties from the time they are weaned until ready for market. In fact, where clean ground free from worm infection is not available it is advisable to keep the young pigs in sties from birth until market weights are reached.

RATIONS.

A. For Pigs in Sties or Dry Lot.—Suitable rations are:—

(*a*) *Maize and Separated Milk.*—Suitable proportions to feed these in are:—

Weaning age to 80 lbs. live weight, 3 lbs. separated milk to 1 lb. maize.

80 lbs. to 125 lbs. live weight, 2 lbs. separated milk to 1 lb. maize.

125 lbs. to market weight, 1 lb. separated milk to 1 lb. maize.

(b) *Maize and Meat Meal.*—Assuming meat meal to have a composition of 50-60% protein, the following proportions are recommended:—

Weaning age to 60 lbs. live weight, 13 lbs. meat meal, 87 lbs. maize.

60 lbs. to 130 lbs. live weight, 10 lbs. meat meal, 90 lbs. maize.

130 lbs. to market weight, 7 lbs. meat meal, 93 lbs. maize.

It is not necessary to include bone meal in the mineral mixture when meat meal is used. Kaffir corn, N'youti or barley can be used to replace half the maize when desired.

Some green or succulent feed should be given with both of these rations.

Cow peas or Kaffir beans, pollard, palm kernel cake may be used in place of the protein supplements just named, but in general better results will be obtained where they form not more than 25 per cent. of the grain ration and the remaining deficiency of protein is made up by some animal by-product. A satisfactory general purpose farm mixture would be maize 70 lbs., cow peas 25 lbs., meat meal 5 lbs.

In sty feeding the addition of 3-5 per cent. of a cut-up legume hay to any ration which does not contain dairy by-products will often improve the rate of gain. This hay can also be fed from a rack or loose in a trough.

The pigs should be fed all the grain they can clean up in 15-20 minutes after feeding. The daily quantity consumed should usually be equivalent to about 3 per cent. of the live weight of the pig. A 150 lb. pig should consume 4½ lbs. of grain or its equivalent per day. Plenty of trough room should be provided, and the pigs should be graded into lots of equal size and strength. Bad doers should be weeded out as they appear and disposed of to the best advantage.

The following figures are a guide to the quantities of grain ordinarily consumed per day by pigs of different weights:—

Weight of Pig.	Amount of Grain per Day.
50 lbs.	2 lbs.
100 lbs.	3.5 lbs.
150 lbs.	4.5 lbs.
200 lbs.	6 lbs.

When feeding baconers on rations which are comparatively low in protein, it is often desirable to bring them on at a slower rate than the optimum in order to prevent them from getting overfat. Porkers should, however, be generally pushed from the start.

B. For Pigs on Pasture.—On good pasture pigs make faster gains in live weight than in sties and require less supplementary protein feed. There is, moreover, a subsidiary advantage, that the pig manure, which is usually lost, is spread on the land without waste.

The most effective arrangement is to plough and sow a fenced area with suitable crops such as maize and velvet beans or cowpeas. This area is then subdivided into smaller camps by temporary fences for grazing. Arrangements should be made for shade and water in each camp and a wallow as well, if possible. It is important to plough up the area each year or to move the camps to fresh land frequently so as to keep the worms in check. Secure fences are required to keep the pigs from straying.

The amount of grain to feed to pigs on pasture is determined by the rate of gain in live weight desired and by the nature of the pasture. The heavier the grain ration, the less pasture will be consumed. A daily ration of about 2 lbs. of grain per 100 lbs. live weight will generally preserve a fair balance between the pasture and the grain consumptions. Thus pigs weighing 150 lbs. live weight would receive 3 lbs. of grain per day.

The nature of the grain ration will depend on the composition of the pasture and the age of the pigs. The table which follows illustrates the quantity of meat meal (50 per cent. protein) required to balance a maize ration on some typical pastures:—

Pasture Crop.	Pigs weighing less than 100 lbs.	Pigs weighing more than 100 lbs.
Kikuyu, paspalum, any young grass	10% meat meal	5% meat meal
Rape, green rye, oats and barley	10% meat meal	5% meat meal
Cow peas, velvet beans and kudzu vine ...	5% meat meal	None

Instead of 10 per cent. meat meal, 15 per cent. ground nut cake or 2 parts separated milk by weight can be used.

It may be necessary to "ring" pigs running on valuable grass sod.

A mineral lick of 3 parts of bone meal and 1 part of salt should be provided.

It is not generally advisable to keep baconers on pasture throughout the feeding period, and the pigs should usually be grown out on pasture to a weight of 130-150 lbs., and then finished in sties or dry lots. This system produces excellent baconers, and the residual stimulating effect of the pasture generally lasts through the finishing period.

Marketing of Pigs.—If possible, the pigs should be got on to dry feed a day or two before marketing. Pigs ship better empty than full, especially in the hot weather, and under ordinary circumstances the morning feed should be withheld on the day of marketing. The pigs should be handled quietly and in the cool of the day, if possible. The normal shrinkage in transit to market is 5 per cent. to 10 per cent.

To prevent fighting en route pigs from the same sties should be shipped together if possible.

THE FEED AND MANAGEMENT OF THE BREEDING HERD.

Feed for Dry Sows and Gilts.—The feed for dry sows and gilts in the breeding herd should be sufficiently liberal to enable the sow or gilt to farrow in the proper condition and to raise a good litter of pigs. Fat sows produce pigs low in vitality and are clumsy to handle at the time of farrowing, while thin sows cannot nourish the average litter properly.

The ration should be well balanced and contain more muscle and bone-forming material than is contained in maize or other grains. As a general guide, mature sows should be fed to gain ½ lb. to 1 lb. daily from the time of breeding to farrowing, and bred gilts, so as to allow for their own growth, somewhat more.

During the summer months pasture is excellent for sows in pig. The range and green feed afforded in this way generally result in large litters and little trouble in farrowing. In the winter months, when pasture is not available, roots or succulent crops such as pumpkins, sweet potatoes or majordas, or a leafy legume hay, should be fed to take the place of pastures.

As the greater part of the development of the embryo pigs takes place during the last six weeks of pregnancy, the ration should be richer in protein—the flesh-forming constituent—during that period than in the earlier stages. The ordinary farm grains, such as maize, Kaffir corn, N'youti, barley, plus a good supply of succulent feed or pasture, will usually be quite sufficient for in-pig sows during the first ten weeks of pregnancy, but during the last six weeks these grains should be supplemented by a protein rich feed. The normal protein requirements at this period can be met by adding 10 per cent. of meat meal or 15 per cent. of ground nut cake, or 2-3 parts of separated milk—all by weight—to the grain ration in use.

If the pasture is scanty and unattractive, feed the sows on a protein supplement throughout the gestation period, increasing the proportion of the supplement towards the end of the period. Good grazing for sows can be found in vleis or on paspalum or kikuyu grass or summer crops sown for the purpose.

The quantity of grain to feed per day should be determined by the condition of the sow. In general, however, ½-1 lb. of grain per 100 lbs. live weight per sow for mature sows and 1½ lbs. per 100 lbs. live weight for bred gilts should be sufficient. A typical ration during the winter months for a mature sow would be:—For the first ten weeks 2-4 lbs. maize meal per day, plus green or succulent feed *ad lib.*, and

for the last six weeks of pregnancy, 3-5 lbs. of a mixture of maize 90 per cent., meat meal 10 per cent., plus succulent feed *ad lib.* During the summer months similar results should be obtained from grain fed at the same rate on good pasture.

Gilts intended for the breeding herd can be fed the same rations as the sows in pig. They should be fed a sufficient amount of grain to ensure good growth and yet not permit them to get too fat. Many good gilts are spoilt by allowing them to get too fat. In general this can be effected on a ration of about 2-3 lbs. of grain per day per 100 lbs. live weight, which will usually work out at from 5-7 lbs. of grain per gilt per day.

To ensure that the pigs receive sufficient minerals, they should have free access to a mineral mixture of bone meal 3 parts, salt 1 part. Some breeders add wood ashes or charcoal to this mixture.

Care and Feed of Sow and Litter at Farrowing.—Previous to farrowing, the farrowing pens or quarters should be thoroughly cleaned and disinfected. Unless a movable colony house in clean camps can be provided, the sows should farrow in proper pens with concrete floors, which can be kept clean and free from parasitic infection. As bare concrete floors are cold in winter and often damp in summer, a boarded section of floor on which the sow can farrow is a great advantage. A small quantity of short bedding should be provided, but, as a rule, the less bedding the better. The pen should be provided with a farrowing rail about 9 inches from the wall and 9 inches from the ground, to prevent the sow crushing the young pigs.

The sow should be removed to the farrowing pen a few days before it is due to pig. The pen should previously have been scrubbed out with boiling water and caustic soda. The udder should be washed off once or twice with soap and water to remove worm eggs, and the sow groomed daily, if possible, to accustom it to handling. The ration should be made more laxative. At this time bran and ground nut cake are good feeds, as they tend to prevent constipation. A day or two before farrowing, cut the ration down to half. Green feed should be given freely if available.

If the sow farrows normally it should be disturbed as little as possible. Young sows sometimes require assistance, but amateurs often do more harm than good by handling the sow at this time, and experienced assistance should, if possible, be secured if help is needed. After farrowing, the after-birth and any dead pigs should be removed, and it is advisable to dust out the farrowing pen with slaked lime.

In the case of large litters, the number of surviving piglets should be reduced to ten or less if the sow has fewer teats available. Runts should be killed at this stage.

During the first day after farrowing the sow should be given no feed, but plenty of water to drink. In the cold weather this should be warmed. On the second day 1 lb. of grain should be given as a slop. This quantity should be increased at the rate of about 1 lb. per day to 4 lbs. at the end of the first week. During the second week the grain should be increased at the rate of ½-1 lb. per day until the sow is on full feed. A rule often followed is to work up to 1 lb. per day per piglet in the litter.

The ration should be one to stimulate milk production, and the sow should be fed to the limit of its appetite. Sows which are good milkers and which have large litters can with advantage be fed three times a day. If the sows are indifferent milkers they will sometimes commence to put on weight after the fifth week. In this case their ration should be reduced sufficiently to maintain only their weights. Where possible, sows and litters should be fed individually. The common practice of combining several sows in one lot is usually productive of a large percentage of runts among the young pigs.

Good rations at such times are:—

1. Maize 1 part, separated milk 2 parts.
2. Maize 9 parts, meat meal 1 part.

Ground cow peas or Kaffir beans can take the place of part of the protein supplements named. Oats, Kaffir corn, or other farm-grown grain can be substituted for part of the maize. Bran is a valuable feed at this time, and if available can with advantage make up a quarter of the grain ration for the first two weeks after farrowing.

If clean pasture is available, the sow and litter can be turned out to graze when the piglets are two or three weeks of age. If such pasture is not available, the sow and litter should be kept in a clean sty.

Three weeks after farrowing, the milk production of the sow usually reaches the maximum, and provision should be made to supplement the milk after this time. A good way to do this is by providing a grain ration for the young pigs in a creep or enclosure to which the sow cannot get. Shelled maize is a good feed to start the young pigs on; later they can be given some of the same ration as the sow. It is important that the young pigs should be eating grain before weaning. The pigs should be weaned at about eight weeks, depending on the condition of the sow and the quantity and nature of the feeds available for the young pigs after weaning. A few days before young pigs are taken away, the ration of the sow should be cut down and the proportion of protein decreased to reduce the milk supply and lessen the danger of udder trouble after weaning. It is usually more convenient to remove the sow from the young pigs than to reverse the process. Weaning should be completed in one operation, and usually it should not be necessary to return any of the young pigs to the sow. Any abrupt change in the feeding of the weaners should be avoided at this juncture.

When the sow's udder has dried up, the ration should be increased to bring the sow into rapidly improving condition when put to the boar. This plan is based on the practice of "flushing" sheep and is conducive to the production of large litters. The best time to cull unsatisfactory sows is after weaning. All sows which are poor producers, bad tempered, clumsy or pig-eaters should be cut out. No market herd can be kept up to a high standard without constant culling. The minimum breeding standard should be the ability to wean six to eight healthy pigs. One of the most effective ways of reducing the costs of production is to raise large litters per sow.

Sows may be occasionally come on heat when nursing litters. It is usually inadvisable to breed them then. They should normally come on heat a few days after the litter is

weaned. They should be bred then, as they hold to the boar most securely then, unless in low condition, when they should be given 4-6 weeks to recuperate.

Shade and Comfort.—During the summer pigs should have plenty of shade. Where natural shade is not available, artificial shelters should be erected. In the hot weather a wallow is of value to keep the pigs cool. A little dip or used motor oil should be poured on the surface occasionally to preserve it in a sanitary condition. The sleeping quarters should be dry.

In the winter the pigs should be protected from cold winds and draughts. The runs should be arranged so that the pigs can get in the sun when they want to. The sleeping quarters should be kept as free from dust as possible.

Particulars of buildings for the housing of pigs has been published in Bulletin No. 863.

VETERINARY SECTION.

Good hygiene is as essential for the maintenance of health amongst pigs as it for that of all animals. Unless they are kept under hygienic conditions and free from disease, either of an infectious or sporadic nature, they cannot thrive or reproduce to the best advantage. We are fortunate in Rhodesia in not having to contend against diseases such as hog cholera (swine fever), swine plague and swine erysipelas which are so prevalent in many other countries. Even our near neighbours in the Transvaal have with them an African type of swine fever which makes pig raising impossible in certain areas.

The absence of such diseases, however, should not in any way be regarded as a reason for failing to adopt the necessary precautions for preventing introduction of disease into one's swine herds; it should on the contrary serve as a stimulus to prevent and control those diseases which do exist, and to ensure that every effort be made to maintain the animals in perfect health.

There are with us, unfortunately, certain diseases which in far too many cases are responsible for failure in raising or marketing pigs, and it is the intention here to deal only

with the most important of these conditions, which are not infectious diseases in the true sense of the term. Before dealing with them, however, it would be well to indicate briefly how to detect any deviation from normal health, and, when such departure is found, what points to pay special attention to in order to obtain information which will assist in arriving at a diagnosis and on which to base curative and preventive treatment.

Most pig breeders are familiar with the normal healthy habits of their stock, relying chiefly on their general appearance and activity, their appetite and the rate of growth or condition as a guide to their state of health.

A normal healthy pig appears alert, the eyes being clear and bright, the skin is clean, and, in young animals especially, has a gloss; notice is taken of any unusual sounds or movements and the animal is active and lively. Mature pigs are considerably less active than young ones, but nevertheless move about readily and are alert if disturbed. At feeding time the animals crowd round and readily—even gluttonously—consume the food when it is given. Young pigs thrive and grow out very quickly on a proper ration, and condition is maintained and increased, the animal appearing well rounded off, the skin evenly and smoothly covering all seats of prominence or depression.

In cases of disease many or all of the above characteristics of the healthy pig, depending on the nature of the disease, are absent. Dullness and listlessness are in evidence in most cases. Movement may be difficult or impossible. The appetite is capricious or may be in abeyance; thirst is increased in most febrile diseases. In diseases which persist for even a few days there is loss of condition and an appearance of general unthriftiness, and if this continues emaciation may become pronounced. In digestive disturbances the act of vomition, or indications of it, may be observed, or there may be signs of diarrhœa or constipation.

In conducting a general examination particular attention should be paid to points such as the above before proceeding to the more detailed special examination.

In observing the symptoms of any disease it is necessary first to examine the animals without disturbing them. This is best done by remaining outside the sty and watching for several minutes—particularly at feeding time. When doing this, particular attention should be paid to the type of breathing of the animal, *e.g.*, whether normal, panting or deep, slow breathing, as this is masked when the pig is disturbed for closer examination.

Having obtained a good general impression of observable symptoms in this way, one should next enter the sty oneself and attempt to make the patient move round, or, preferably, get some one else to do this, and carefully note any peculiarities of movement, reluctance to walk or distress on walking.

One should next proceed to a closer examination of the animal. For such an examination it is necessary to have the patient caught and held securely by one or more assistants, but it is essential that the animal be dealt with carefully and not unnecessarily chased about. This examination includes taking the temperature—the normal varying from about 101 degrees F. in the morning to 103 degrees F., or even a few points more, in the afternoon—observing more closely any abnormalities already detected, *e.g.*, any swellings or discharges, and noting any other points likely to assist in diagnosis, *e.g.*, the state of the breath and the colour of the mucous membrane of the eye and mouth.

Should an animal die a *post-mortem* examination should be made, unless there is any suspicion that the disease may be anthrax, in which case the carcase should on no account be opened, but a blood smear made, care being taken that as little blood as possible escapes from the incision, and veterinary advice immediately sought. When a large number of pigs are suffering from any disease it is advisable to slaughter one and carry out a *post-mortem* examination with a view to arriving at a definite diagnosis, and hence being able to institute effective treatment for the others.

A *post-mortem* examination to be of any use must be thorough and must be performed as soon after death as possible; this is particularly important, as putrefaction sets in very rapidly and masks any changes in the organs which

might otherwise have been detected. In order to be able to observe any deviations from the normal it is necessary to have a good idea of the general appearance of organs of healthy pigs, and one is therefore well advised when slaughtering pigs for consumption to spend some time in studying the appearance of such organs as the lungs, heart, liver, spleen, kidneys, stomach and intestines. Being familiar with the normal fits one much better for distinguishing disease changes when these are encountered.

A *post-mortem* examination is not complete unless all the above-mentioned organs are examined, and, in the case of the stomach and intestines, these should be opened with a pair of scissors throughout their entire length. Many deaths are attributed to mysterious diseases when the owner himself, by opening the stomach and intestines, could easily have found the true cause in the shape of masses of round worms (*Ascaris*).

To adopt preventive or curative treatment without being able to diagnose the trouble is a most unsatisfactory, useless or even harmful procedure, and it is for this reason that some time has been spent on describing the essentials of clinical and *post-mortem* examination.

Measles (*Cysticercosis*).—The infestation of pigs with measles undoubtedly is responsible for the greatest number of carcases which are condemned as unfit for human consumption.

A measle (*Cysticurcus cellulosæ*) is the cystic, bladder worm or development stage of the human tape worm (*Tænia solium*). The pig is therefore the secondary host, harbouring only the immature stage, of an intestinal parasite of man, who is the primary host.

The life cycle is passed through in the following manner. Starting from the adult tape worm in the human intestine, eggs are produced and pass from the worm into the contents of the bowel, and are voided in the excreta. Such contaminated excreta may then be eaten by a pig, in which case the infective eggs on arrival in the stomach are acted upon by the gastric juices, the shell is dissolved and a minute parasite liberated. This embryo perforates the stomach wall, and, by migration into and transportation by the blood stream, arrives in the muscular system, where it undergoes further develop-

ment, changing from the young embryo to a bladder worm (measle) stage. When fully developed and mature this is infective to man. and if the infested pig is slaughtered and the flesh containing the cysts eaten it develops further, becoming a tape worm located in the intestine. This matures and in turn develops eggs, and the life cycle is repeated.

The cyst may first be visible to the naked eye three weeks after becoming seated in the muscle. At this stage, however, it is easily missed. With development it enlarges, varying in size up to that of a small pea. It has a bladder-like appearance, light blue in colour and transparent with a white spot inside, which is the head of the future tape worm. The cysts are mature, *i.e.*, fully developed and infective, after three to four months' development. Sometimes even before this stage, or at a variable later period, they degenerate, becoming opaque and hard, in which case they are no longer infective.

No symptoms are observable in the living pig. Infection is only diagnosed when the muscles are cut open after death, with the exception of those rare cases in which the measle cysts are visible on the under surface of the tongue. The parts in which the cysts most commonly occur are the muscles of the tongue, neck, thigh, forearm, heart, diaphragm and cheek.

There is no method of destroying measles in a live pig. Treatment therefore being useless, preventive measures are all that remain. Fortunately, owing to the knowledge of the life history of the parasite, these are simple and completely effective, and consist of preventing pigs from eating infected human fæces, or food contaminated with such. Infected humans should be put under curative treatment, and the use of latrines be encouraged, and finally, infected carcases of pigs should be destroyed to prevent further infection of man.

Ascaris Suum.—This is the most harmful worm parasite of pigs. Its habitat is the small intestine, and in this position sometimes hundreds may be found. It is a large worm, light cream in colour, five to eight inches long and about the thickness of a clinical thermometer or its case. No intermediate or secondary host is required for the life cycle. Eggs laid by the female parasite in the intestine pass out with the fæces,

and under favourable conditions of warmth and moisture the embryos, still in the shell, develop on the ground to an infective stage in ten to fourteen days. Such eggs are very resistant to unfavourable influences, such as frost, drying and even ordinary disinfection, being stated to remain infective for up to five years or more. Such a ripe egg when ingested by a pig is acted upon by the gastric juices, and the larva is liberated in the stomach. The larva now bores its way into a blood vessel, and is carried to the liver, and thence to the lungs, where further development occurs. From here it passes into the bronchi, up the wind pipe, is coughed out through the larynx, swallowed and passes again into the stomach and into the intestine, where it matures. The period of migration occupies about ten to twelve days.

The symptoms are variable on account of the complex development of the parasite. Their presence in the lungs frequently causes pneumonia in young pigs, the symptoms then being dullness, loss of appetite, difficult breathing and a cough. Death may result from a severe lung infection in one to two days. Where infection is less severe the young pigs are stunted and unthrifty, and show symptoms of coughing and difficult breathing. The cough may improve, and the only persistent symptoms are those of unthriftiness and distressed breathing (snuffles). Weaners may show the above symptoms, but usually the symptoms are more indefinite, the animals being stunted, pot-bellied and weak in spite of good food. Sometimes convulsive fits occur at feeding time. Symptoms are most pronounced in young pigs; adults may show a slight cough and lose condition. *Post-mortem* appearances depend on the symptoms noticed, *e.g.*, pneumonia, when the young pigs die as a result of acute infection. Where the disease has persisted for a fortnight or so the mature worms are found in the intestine, and here there may be noticeable ulcers and hæmorrhages.

Treatment is only recommended in conjunction with prevention. It is no use allowing treated animals to remain on infected ground, especially when it is realised that the ripe eggs are so resistant. It consists of starving the animal for 24 hours and then drenching it with chenopodium oil and castor oil at the rate of 1 c.c. of the former and 8 c.c. of the

latter for every 25 lbs. body weight. These drugs may be given in a little bran or mealie mash, but are then less reliable. The pigs may be fed as soon as the purgative has acted.

Prevention varies according to circumstances. Where infection does not already exist care should be taken to prevent its introduction, *e.g.*, by procuring pigs from a known clean area, or, if any doubt exists, even these should first be freed from all infection by treating as above.

On infected farms the pigs may be moved to an area previously kept free, taking precautions to treat them before removal. If this is impracticable, a sow should be thoroughly scrubbed and washed immediately before farrowing to clean her skin of eggs which may be present in the adhering dirt. She should be placed in a farrowing pen which has been previously cleaned with boiling water and caustic soda. Within ten days after farrowing the sow and her litter should be removed to a clean field planted with some suitable crop, the sow being removed after the young are weaned, and the weaners remaining there to grow up in safety. This method has been found to give excellent results whenever practised.

Scours (*Diarrhœa*).—One of the most common conditions causing serious losses in sucklings is scours. The cause can usually be traced to unsanitary conditions, wrong feeding or intestinal parasites. The feeding of the sow on mouldy or fermented foods, excessive maize, at irregular periods or suddenly changing her diet are frequently responsible for scours of sucklings. Diseases of the udder or infectious diseases of the sow are also manifested as scours in her litter. The symptoms are obvious. The fæces are fluid or pasty, frequently voided, light coloured and foul smelling, and the tail and hindquarters are soiled. Death may occur early or the disease may persist with marked loss of condition.

In weaned and older pigs the condition is also due to similar causes, bad and wrong food being the usual, if infectious disease and parasitism are excluded.

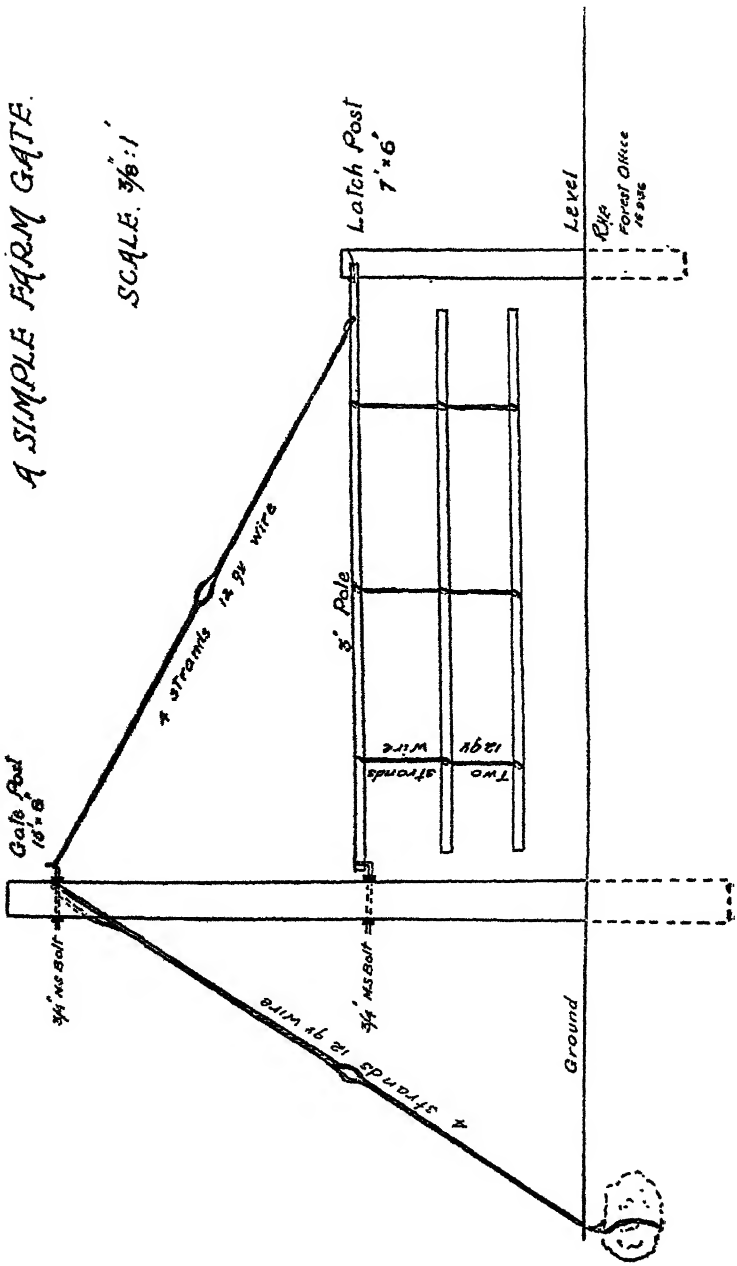
Treatment consists of removing the cause, *i.e.*, the food, and hygiene should be immediately corrected. A purgative, castor oil, should be administered with a view to eliminating

the irrating substance; in the case of sucklings the sow should receive the treatment. If the condition still persists, lime water given with the food in doses of 5 to 10 ozs. is said to be effective. Should parasites be responsible, the animals should be treated as recommended for ascaris infection.

Constipation.—This is usually the result of too concentrated foods, especially in conjunction with limited exercise. The food should therefore be corrected and provision made for sufficient exercise.

If the condition is acute an enema should be given. Purgatives, such as castor oil, linseed oil, or epsom salts, are also useful.

Pregnant sows should be allowed 3 ozs. of linseed oil daily in their slop feed as a preventive.


A SIMPLE FARM GATE.
SCALE. 3/8":1'
Latch Post 7'×6"
Level
4 strands 12 gu wire
3" Pole
Two strands 12 gu wire
Gate Post
3/4" M.S. Bolt
3/4" M.S. Bolt
Ground
4 strands 12 gu wire

A Simple Farm Gate.

Contributed by the Division of Forestry.

In response to a number of requests from interested visitors at the Division of Forestry's stand at the Agricultural Show a design for a simple farm gate is now reproduced.

This type of gate has several advantages. It is easy to construct and little or no maintenance is required; the only parts liable to break being made of ordinary 12 guage fencing wire.

In cases when animals are kept on one side only a little care in erecting the gate post will result in the gate always swinging closed. The arrangement of the bars which are hung by wire from the top bar makes it all but impossible for an animal to break the gate, since they do not present a solid obstruction but swing forwards when pushed.

The gate post consists of a straight 15 foot pole which is bored with a ¾ inch hole at points 7½ feet and 14 feet from the butt.

Into these holes are inserted ¾ inch iron rods threaded for about 8 inches and bent in the form of a right angle at about 3 inches from the opposite end. A nut is placed on either side of the gate post to prevent these rods from moving.

The gate post is then erected more or less perpendicularly and is sunk 3 feet in the ground so that the lowest rod is 4½ feet above ground level.

The latch post and stopping post should now be erected, these should be about 7 feet in length and should stand 5 feet above the ground. If the ground slopes away from the gate the stopping post will have to be longer.

The top rail of the gate is now placed in position; the length of this will depend on the width of the gate.

A diameter of 2½ to 3 inches is ample for the rails. About 2 inches from the butt end a ¾ inch hole is bored so that the pole can be fitted over the upturned portion of the lower rod.

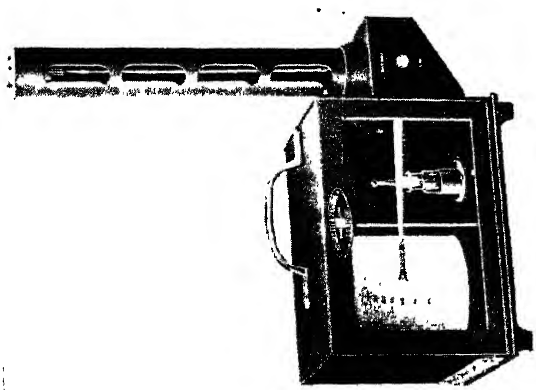
About 18 inches from the small end a $\frac{1}{4}$ inch hole should be bored; through this hole 2 or 3 strands of No. 12 gauge fencing wire should be threaded and led round the topmost rod. The wire should then be twisted until the rail hangs level. The small end of the rail should overlap the latch post if the gate is to swing in one direction only.

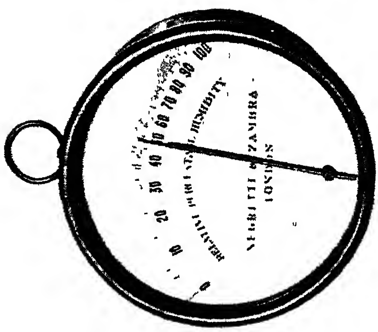
A loop of wire may be fitted to the end to fit over the latch post.

Two or three further rails are now hung at suitable intervals by means of three lengths of wire wound round the top rail.

A little experience is required to make the gate swing efficiently. Probably two straining wires will be found most suitable. These should be attached to stones buried in the ground and by gradually tightening the wire the gate post can be moved in such a position that the gate swings shut.

All wood, especially that in contact with the ground, should be treated with preservative.





The Flue Curing of Virginia Bright Tobacco

IN SOUTHERN RHODESIA.

ADVANTAGE OF THE USE OF RECORDING INSTRUMENTS AND DIRECT READING HYGROMETERS IN BARNS.

By W. F. Collins, A.R.S.M., Sometime National Scholar in Biology, Injina, S. Marandellas.

PART II.

Part I. appeared in the August *Journal*.

Use of Recording Hygrometer.—In the 1931-1932 season's work ordinary wet-bulb hygrometers were used and were found to be exceedingly inconvenient. They require incessant calculations, they are of doubtful accuracy at relatively low humidity and afford no useful indication to the "boy" in charge of the firing of the barn. A recording hair hygrometer was found to have the great advantages of:—

1. Supplying a permanent and visible record unfolding itself over the whole period of curing.
2. Clearly indicating humidity by a pointer in a manner immediately understood by any intelligent native.
3. By reason of its record preventing the barn boy from neglecting his work and thus greatly reducing the strain of night-work.
4. Facilitating effective moisture-control and enabling drying-out to be done by air of continuously increasing dryness, thus avoiding risk of precipitation and chill of the leaf.
5. Assisting in securing that the critical drying period shall be as short as possible.

6. Providing a record of moisture conditions within the barns during the conditioning of the barn-load preparatory to emptying.

The hygrometer used depends on expansion and contraction under varying humidity of a hair filament. To the loose end of the filament a lever pointer-arm is attached indicating relative humidity directly on a scale.

A combined instrument giving a record of both temperature and humidity on the same chart has since been placed on the market.

During the 1933-35 season a cheaper dial pocket-type of direct reading hygrometer has been found to be very convenient. Though this type produces no permanent record, it enables the barn-boy to read the moisture-condition of the barn at a glance.

Definition of Sponging.—Little research appears to have been made as to the exact nature, causes and effects of "sponging," a broad term covering several forms of damage more or less alike in result. Garner defines it as "splotches of red and brown" and as due to the conditions resulting "if the leaf still contains very much moisture when the yellowing has been completed," also to "insufficient ventilation toward the end of yellowing." Brown states that it is due to excessive moisture and delayed drying, also to "moisture collecting on the surface of the leaf." Whether on the upper or lower surface is not stated. The Electricity Commission found that "Smudging of the leaf can be produced by reducing the temperature only 5 degrees in a saturated atmosphere," furthermore, an "almost complete absence of bright leaf" resulted from endeavours to "yellow" the leaf in air-tight barns.

Brown describes another form of sponging during the fixing stage.

"Another discoloration is caused through the cells of the leaf being prematurely killed, preventing the necessary chemical changes taking place. This happens when the ventilation is excessive and the temperature is increased too rapidly; the leaf in this case has a dark greenish red or blackish coloration." (Tobacco Culture, p. 235.) He thus describes two forms of sponging as capable of being produced

by two separate and distinct causes, delayed drying on the one hand and excessive ventilation with too rapid temperature-increase on the other during the fixing stage. This latter form is probably exceptional. It has not been observed by the writer under working conditions. The Electricity Commission finds that a sudden rise in temperature will invariably produce discoloration but that withdrawal of moisture alone, at constant temperature, however much accelerated, even with forced dry air, cannot do so.

It is surprising that it has not been remarked that sponging, when slight, appears first on the upper side of the leaf. The breathing mouths or stomata being normally situated on the underside of plant-leaves it is suggested as a basis of study that sponging is a more or less severe discoloration due to chemical changes starting in cells least able to breathe. Moisture, in evaporating, takes up much heat from the nearest available conductor. It appears more than possible that the main cause of sponging is severe chill resulting from the sudden and excessive local drop of temperature due to evaporation of condensed moisture.

Excessively over-ripe leaf, in which the breathing-cells are presumably already dead when picked, provides an extreme case of sponging. Another cause is scorching of leaf by exposure to the sun, after picking. Another form may be produced in curing after bruising a fully ripe leaf between the finger and thumb. The sponging is then apparent on both sides of the leaf. Disease of the leaf, such as white mould, is another cause of sponging. Wetting of the leaf, as from a leaky barn roof, during the later stages of curing, will cause the leaf to turn black. This, however, is perhaps an entirely distinct chemical change.

A factor in sponging, hitherto unrecorded, appears to be due to weak constitution of the plant. It is found that leaf from first-year lands sponges less readily than that from lands under tobacco two years in succession. From unmanured lands under tobacco three years in succession the crop is exceedingly difficult to cure on account of its great susceptibility to sponging. It is suggested that humus-deficiency may be the cause. On the other hand, land too rich in humus will cause the tobacco to cure out too dark.

Severe sponging frequently results from careless tying. If three, four or more leaves are tied front to back in series so as to leave no space for the escape of moisture, it will be commonly found that severe sponging has spread right through the hand where the leaves were in closest contact.

Crushing of the upper part of the leaf during tying will delay ripening of that part of the leaf in the barn. This part will remain green or may become sponged.

It would appear that sponging may be divided into two main categories:—

1. Improper heat and moisture treatment in the barn—barn-sponging. The use of a recording hygrometer and thermometer providing an accurate record of what has taken place during curing will go far to secure that this barn-sponging shall be reduced to a minor quantity. If moist atmosphere and breathing air be suitably regulated up to yellowing, and the drying of the leaf be carried out with aid of which the dryness is continuously increasing, there will be little barn-sponging.

2. Improper cultural or handling conditions at the early stages of the reaping season with but a small proportion of the leaf over-ripe the curing-out of perfect barn loads of leaf is frequent. Towards the end of the season cultural conditions become far more difficult. Ripening slows up, green, ripe and over-ripe areas commonly occur on one and the same leaf. A certain amount of sponging is therefore unavoidable.

Temperature at which Drying Out should commence and be carried out.—The Electricity Commission's experiments demonstrate that good fixation of colour and drying out are possible at 90 deg. and that at the end of yellowing, maximum brightness of colour with complete absence of sponging can be

secured, even at this low temperature, by high-speed drying-out procured by an exhaust fan, and artificial means hardly practicable outside the laboratory.

This and the previous observations appear to indicate that the aim of curing on a practical scale should be to "yellow" at minimum temperature and then to extract as much moisture as possible at low temperature by means of utmost through ventilation with air at its driest.

Experience with the 1932-1933 Season's Crop.—During the curing of the 1932-1933 crops at Riverside the earlier part of the crop was cured in accordance with the experience of the previous sixteen years. The results were not satisfactory and efforts were made to follow implicitly the directions of the recognised authorities. Leakages were sealed and the barns were kept closed during the yellowing stage. The atmosphere was maintained at the utmost degree of saturation. Records of temperature and moisture were plotted on squared paper for each barn-curing. The maintaining of saturation was found to be exceedingly difficult for, failing keeping the barn-floor almost awash and the sidewalls continuously syringed it was found that variations of ten to fifteen degrees of relative humidity were apt to rule within two or three hours even during the daytime, with the barns under constant white supervision. Furthermore, it was found exceedingly difficult to extract moisture from the floor of the barn towards the end of the yellowing age. The critical "fixing" period during which the leaf was most susceptible to sponging, between the temperatures of 85 and 120 deg. F., had on account of slow drying in the barn to be as long as 42 hours. The downward moisture curve was flat and uneven and the curing still exceedingly unsatisfactory.

Previous experience with thatched-roof barns had suggested that the existing provision for through ventilation in iron-roofed barns during the drying-out stage was altogether inadequate. The air-current was often slow and adverse

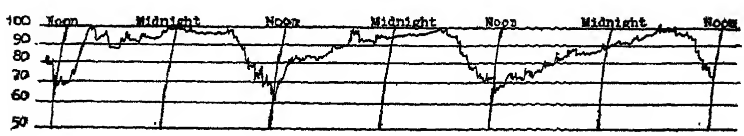
winds were apt to cause it to be completely stagnant. Raising of sections of the corrugated roof was tried as an experiment. Doubling of air-vents on both sides of the roof was finally adopted.

The trouble as a whole, however, was attributed largely to the fertiliser used, because it would very commonly occur that on any stick in a barn there would be found some leaves of good colour while the rest were at various stages of partial to complete sponging.

It was felt that both external and internal air and moisture-conditions required closer study and that specially designed temperature and moisture-recorders would be likely to render great assistance.

Rhodesian Moisture Conditions.—On receipt of recording instruments from England a preliminary record of humidity in the external (shaded) air was taken. It showed at once that the relative humidity of the feed-air of the barn follows a regular curve with its minimum at mid-day and approximate saturation at about 6 a.m. Shortly after rain the mid-day relative humidity is about 70, while in sunny weather the mid-day humidity sinks to 40 and even less, towards the end of the curing season.

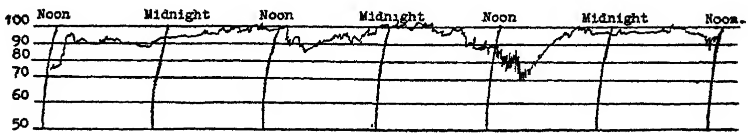
The external moisture as well as temperature-conditions at the high Rhodesian altitude are very different from those prevailing at lower altitudes and its seems reasonable to assume that special precautions must be taken to ensure that they shall not interfere with the conditions within the barn, conditions which presumably should conform as closely as possible with those which produce leaf of accepted flavour and aroma in America.



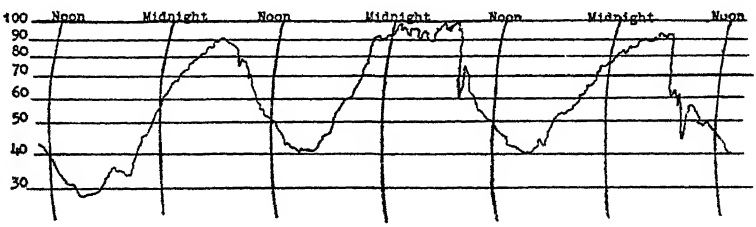
Daily record of external moisture conditions during the rainy season. Noon Jan. 19th, 1933, to noon, Jan. 22nd. End of a short dry spell.

Temperature, and especially night temperature, through the season, is an important factor both in the ripening of the

leaf and in the moisture-content of the air for drying. At Riverside the day shade temperature reaches a maximum of about 95 during the hot season. The night temperature, and consequently the amount of moisture absorbed and carried by the night air, decreases rapidly from the end of March. In consequence the volume of night air entering the barn through the lower ventilators must be decreased towards the end of the curing season.



Daily record of external moisture conditions during the rainy season. After rain. (5.04 in. during the night of Jan. 22nd.)



Daily record of external moisture conditions after the end of the curing season. Aug. 3th, 1933, to Aug. 6th, 1933.

It is evident from these curves that during rainy weather the maintaining of a high degree of humidity during the long yellowing stage of curing, is easy. In sunny weather it is far more difficult. It is not surprising therefore to find that after a spell of rainy weather the barn-boys become careless and poor yellowing is apt to be experienced on account of neglect by the barn-boys to keep up the humidity in the barn.

(To be continued.)

EGG MARKETING BILL.

DRAFT OF A BILL HAVING FOR ITS PURPOSE THE MORE ORDERLY MARKETING OF EGGS.

(*Reprinted for purpose of referendum.*)

The general position of the Poultry Industry in Southern Rhodesia of recent years has caused considerable anxiety both to producers and to the Department of Agriculture. A period of marked expansion in 1930-31 was followed by an acute depression during 1932-33, when considerable numbers of poultry keepers went out of production on account of the low prices realisable for eggs. More recently while surpluses have been produced in the flush season, scarcity of supplies, accompanied by high prices to consumers, has been experienced in winter, entailing considerable imports of eggs from the Union of South Africa. Present indications denote that the industry is expanding once again, and it is not unlikely that before long surpluses in excess of local requirements of eggs will be produced, which may well necessitate export overseas in the flush period of the year.

Various schemes to achieve a more orderly system of marketing have been submitted to the Department of Agriculture for consideration, by leaders of the industry, but for reasons explained by the Director of Trade and Industry in his following memorandum the egg industry is a difficult one to which to apply a system of regulated marketing, largely on account of the keeper of poultry for home use, and the native producer, who enter the market in the flush season and thereby aggravate an already over-supplied market.

Proposed voluntary agreements between producers and merchants have not fully materialised, and finally after numerous discussions with those interested the Minister of Agriculture and Lands decided to request the Director of Trade and Industry, in consultation with the officers of the Department of Justice and the Poultry Officer, to submit a draft Bill having for its object the orderly marketing of eggs within the Colony.

It is believed that the Bill published in this issue of the *Rhodesia Agricultural Journal* is in essential details approved by a considerable number of producers. The normal course to adopt in the case of such proposed legislation is to publish the Bill in the *Government Gazette* prior to the session of Parliament at which it will be presented. In the present instance, however, it is desired that all interested producers, merchants dealing in eggs and consumers, should have the fullest opportunity of considering and discussing the implications of a legislative enactment which either in the form now submitted or in a somewhat similar form seems likely to become desirable at no distant date.

It must be emphasised that the Government does not intend to proceed with the Bill in its present or in an amended form, until there is a general demand for it, but in the meanwhile it is hoped that all those in the Colony concerned in the production and marketing of eggs will give the question their very full and thoughtful consideration.

H. G. MUNDY,
Secretary,
Department of Agriculture and Lands.

27th August, 1935.

MEMORANDUM ON THE DRAFT EGG MARKETING BILL.

By E. R. JACKLIN, Director of Trade and Industry.

The draft Bill, which follows, is the outcome of an instruction to prepare a scheme by which the price received by the egg producers—and the price paid by his customer—could be regulated at a figure which the Government may consider reasonable and fair to both parties.

The administration of market regulation in the case of a highly perishable product like eggs presents special difficulties. The system which best avoids or combats these difficulties, a general pool on the English model, seems in local

circumstances neither desirable nor practicable, both because it involves compulsory delivery of eggs to central depots and because the egg business is carried on in certain districts in circumstances which make it desirable to have a flexible system which does not interfere with local conditions and the local course of trade.

In these circumstances it has been the endeavour to present a system which, while giving in large part the effect of a general pool, will not interfere with the free course of trade. The proposals embodied in the draft Bill will in fact—

(*a*) leave the producer's choice of a market legally untrammelled so that he will retain absolute discretion as to whom and at what price he sells;

(*b*) avoid direct and arbitrary interference with the existing course of trade and such incidents to it as the merchants' contra account system;

(*c*) enable the effect of price regulation at places distant from the central markets to be tempered or eliminated where desirable without giving the loss of control and the administrative difficulties which result from statutory exemption;

(*d*) maintain any geographical advantage enjoyed by producers in relation to particular markets; and

(*e*) avoid increased inducement to producers in outlying districts to deprive local customers of supplies by transferring their eggs to the central markets.

The essential features of the scheme are given in the following paragraphs:—

Board of Control.—A Marketing Board is to be established consisting of two producer representatives, two commercial men and one Government representative (Section 4).

Right to Sell and Buy Freely.—The producer is to have the right to sell to whom he likes or at his option to deliver any of his eggs to the Board (Section 6). The public's right to purchase from any producer or native will be equally unrestricted. A purchaser will not, however, be allowed to surrender any of the eggs he acquires for participation in the Board's pools, as the producer may do.

Monthly Returns.—The producers will furnish monthly returns showing to whom they sold, the quantity and the date of the transaction (Section 7 (1)). A return giving similar details of purchases from producers and natives will be required from merchants and certain classes of large consumers who buy direct from producers (Section 7 (2)). Only one simple return a month will be required. Their purpose will be apparent later when the levy clauses are discussed. They will be cross-checked so that evasion of the control will not be possible without the collusion of both producer and purchaser.

The classes of consumers from whom a return of purchases from producers will be required will be prescribed by regulation and may include hotels, hostels, messes, etc. The householder will not be affected in any way. For information regarding the purchases of small consumers direct from producers, the Board will rely on the returns from the producers.

The returns specified will give the Board a record of the eggs sold by producers. Natives are not treated as producers. They do not sell eggs to any extent; but when they sell to traders or large consumers the purchaser's return should show the quantity.

Board's Pool.—The Board will operate a monthly pool or a series of periodic pools of the eggs which producers choose to surrender to it for sale and will be prepared to sell from such pools to merchants and "wholesale purchasers" at a price which will be subject to the Minister's general approval. The Board will also undertake any necessary export of surpluses and ensure so far as possible that valuable markets in neighbouring territories are retained and developed.

The various powers incidental to the operation of pools are provided in Section 12.

Levy on Purchases.—We come now to the purpose of the returns from producers, etc. It is proposed that merchants and such large consumers as are required to furnish returns will pay a levy or contribution to the Board's pool on the purchases they make from producers and natives (Section 8

(1)). In the case of sales by producers to householders and small consumers who are not required to furnish returns, the contribution will be collected from the producer. Section 9 (1)).

The amount of the contribution will be the difference between the Board's selling price in the place and at the time concerned and the price distributed by the pool of the period. (Section 8 (2) and 9 (2)). This arrangement will give as closely as possible the financial effect of a general pool. The matter needs close explanation.

Let us suppose that a general pool was established and the merchant ("purchaser") was made to surrender the eggs he acquires from producers and natives to the pool. He would then become a participant in the pool and would share in the pool pay-out. At the same time he needs eggs to supply to his customers and would have to buy his requirements from the pool. In respect of this purchase he would be charged the selling price asked by the pool, say, 1/6 per dozen, and in respect of his participation in the pool he would be entitled to the pool pay-out, say, 1/3 per dozen. The amount due to him would be set off against the amount he owes and he would remit to the Board the difference of threepence.

In the draft Bill a short cut to this position is taken, it being simply provided that a contribution calculated by the Marketing Board in the manner described shall be paid to the Board.

The description of this system may sound complicated, but the operation of the system itself will, in fact, be otherwise. It resolves itself into a simple return once a month from producers and certain purchases and, in the Board's office, a cross check of returns and a little simple bookkeeping.

Fixed Levies from Merchants.—There is one important objection to this means of levy assessment which required to be removed. It leaves the merchant who buys from a producer in ignorance of the amount of the levy he will have to pay to the Board until he receives a debit note on the closing of the monthly or period pool. He will therefore not know his total cost price and so will have difficulty in fixing his selling price. The point is met in the Bill by a provision

that the merchant may, if he chooses, require the Board to quote him a definite figure before the beginning of each month. (Section 8 (3)). If at the close of the pool the figure quoted him should prove to be higher than the contribution calculated as provided in the Bill, he will be entitled to a credit, that is to say the excess will be refunded to him. If it should prove to be lower, the pool will bear the loss.

Reasons for Method Proposed.—It may be asked why a variable contribution to the pool assessed as proposed in the Bill is preferable to a fixed levy. The reasons are exceedingly important, but they can only be shortly indicated here:—

(*a*) The method establishes the effect of a general pool without the costs and losses attendant on physical handling. By this means it avoids an arbitrarily fixed levy on merchants, etc., which may be more or may be less than is actually necessary to the object of market regulations, namely, an equitable price to the producer.

(*b*) It will not be desirable to collect the same levy from all districts irrespective of geographical and other difficulties and circumstances. By assessing the levy on the basis of the Board's selling price in the relative place and circumstances it is made possible to reduce or eliminate the levy when desirable.

(*c*) Consideration will show that the system will encourage the merchant who buys from a producer to pay him a price equivalent to the payment he would obtain from the pool in the relative circumstances. The producer would otherwise consign to the pool and thereby dislocate the trade in his area.

(*d*) It is desirable that the merchant be induced to maintain his selling prices in a certain conformity or relation to the pool's wholesale selling price. These prices being variable, it will probably be necessary to influence his cost price in a variable degree.

(*e*) Seasonable variation of supplies may necessitate a comparatively large levy in certain months and a small one in winter. The amount necessary is logically reflected or established by the difference between the pool pay-out and the pool selling price.

There are obviously several reasons for this, but one is enough to examplify the point. In the flush season the pool may have to export and the amount of the levy will be such as will spread the burden of export fairly. In winter no export will probably be necessary and the levy may then be much lower.

Exemption from Levy.—It has been said that under the system proposed the levy could be reduced or eliminated altogether where geographical or other circumstances justify. This should prevent hardship, and from the poultry farmers' point of view it is desirable, because it would be wrong to establish a standard of returns to producers in outlying districts which would encourage uneconomic production. Eggs will not stand long road transport.

BILL

To provide for the compulsory control of the marketing of eggs.

BE IT ENACTED by the King's Most Excellent Majesty, by and with the advice and consent of the Legislature of the Colony of Southern Rhodesia, as follows:—

Short Title and Date of coming into Operation.

1. This Act may be cited for all purposes as the "Egg Marketing Act, 19...," and shall not come into operation unless and until the Governor has declared by Proclamation in the *Gazette* that it is His Majesty's pleasure not to disallow the same. Thereafter it shall come into operation on such date as the Governor shall by the same or like Proclamation declare.

Interpretation of Terms.

2. In this Act, unless inconsistent with the context—

"egg" means the egg of the domesticated fowl;

"Minister" means the Minister of Agriculture and Lands;

"native" means any member of the aboriginal tribes or races of Africa, or any person having the blood of such tribes or races and living among them and after the manner thereof;

"prescribed" means prescribed by regulation made under this Act;

"producer" means any person other than a native who himself or by means of his agents or servants produces and sells or otherwise alienates eggs or who imports eggs for the purposes of incubation;

"purchaser" means any person who purchases or otherwise acquires eggs from any producer or native or who imports eggs for any purpose other than incubation.

Establishment of Egg Marketing Board.

3. As from a date to be fixed by Proclamation in the *Gazette*, there shall be established a Board to be known as the Egg Marketing Board (hereinafter referred to as the Board), which shall be a body corporate capable of suing and being sued in its corporate name, and, subject to the provisions of this Act, of performing all such acts as bodies corporate may by law perform.

Constitution of Board.

4. (1) The Board shall be appointed by the Governor and shall consist of a Government official, a member of the Bulawayo Chamber of Commerce, a member of the Salisbury Chamber of Commerce and two producers.

(2) The members of the Board shall hold office for a period of two years; on the expiry of his period of office, a member of the Board shall be eligible for reappointment.

(3) Any casual vacancy on the Board shall be filled by a nominee of the Minister.

(4) The Board may appoint from its own members an executive committee, not exceeding three in number, one of whom shall be the chairman of the Board and one a producer.

(5) The Government official shall be chairman of the Board and of the executive committee and shall have a casting vote only.

(6) The Minister may appoint any member of the Board to act as chairman whenever through illness, absence or other cause it may be necessary to do so, and the member so appointed to act shall during the term of his appointment be chairman of the executive committee and otherwise exercise and fulfil all the powers and duties of the chairman of the Board.

(7) The chairman and members of the Board shall be paid out of the funds of the Board such remuneration or allowances as the Minister, with the advice of the Board, may from time to time determine.

Power of Land Bank to make Loans to Board.

5. Notwithstanding anything contained in the "Land Bank Act, 1924," as amended from time to time, or any other law, it shall be lawful for the Land and Agricultural Bank of Southern Rhodesia to make loans to the Board.

Producers must surrender to Board eggs not otherwise disposed of.

6. (1) Except as provided in sub-section (3) of this section, a producer shall surrender to the Board at such time and place as the Board may direct all eggs which he produces and which he does not alienate to a purchaser nor retain himself either for consumption in his own household or for incubation.

(2) Eggs surrendered to the Board shall on the issue of a receipt by the Board be vested in and become the property of the Board, but the risk and profit in them shall not pass to the Board until the issue of the Board's receipt.

(3) Eggs, which the Board has refused to accept in terms of paragraph (*o*) of section twelve of this Act, shall not be surrenderable to the Board.

Monthly returns to be submitted by all producers and by certain purchasers.

7. (1) Every producer shall, not later than the seventh day of every month, render to the Board a return showing the

number of eggs alienated by him to any purchaser during the preceding month and such other particulars as may be prescribed.

(2) Every purchaser, who belongs to such class or classes as may be prescribed, shall, not later than the seventh day of every month, render to the Board a return showing the number of eggs purchased or imported or otherwise acquired by him during the preceding month and such other particulars as may be prescribed.

Contributions to be paid by certain purchasers.

8. (1) Every purchaser, who belongs to such class or classes as may be prescribed, shall pay to the Board on all eggs which he purchases or imports or otherwise acquires from producers or natives a contribution assessed in accordance with the provisions of this section.

(2) The Board shall debit the purchaser with the price which the Board would have charged him had he bought from it the eggs which he so imported or acquired, and shall credit him with the distribution to which he would have been entitled had he been a participant in the Board's appropriate pool or pools in respect of such eggs. The excess of the debit over the credit shall represent the contribution due by such purchaser and shall on notification from the Board immediately become payable by him to the Board.

(3) Instead of paying the contribution as in the last preceding sub-section provided, the purchaser may before the beginning of each month contract with the Board to pay an agreed contribution per dozen on all eggs imported or acquired by him during the succeeding month. If on the closing of the accounts of the relative pool period such purchaser has paid more under such contract than he would have been liable to pay as a contribution in terms of the preceding sub-section, the Board shall refund him the excess.

Contributions to be paid by certain producers.

9. (1) Every producer, who belongs to such class or classes as may be described, shall pay to the Board on all eggs which

he alienates to any purchaser to whom the provisions of section *eight* do not apply a contribution assessed in accordance with the provisions of this section.

(2) The Board shall debit the producer with the price which the Board would have charged him had he bought from it the eggs which he so alienated, and shall credit him with the distribution to which he would have been entitled had he been a participant in the Board's appropriate pool or pools in respect of such eggs. The excess of the debit over the credit shall represent the contribution due by such producer and shall on notification from the Board immediately become payable by him to the Board.

Contributions to be credited to Pools.

10. The Board shall credit to the pool or pools operated by it in such proportion as it may determine all moneys paid by purchasers and producers under the provisions of sections *eight* and *nine*.

Power of Board to reduce or waive Contributions.

11. The Board may in its discretion reduce or waive entirely the contribution due from any purchaser or producer in terms of this Act when by reason of the geographical position of such purchaser or producer or for any other reason whatever such action seems to it desirable.

Powers of Board.

12. (1) The Board shall have the power—

(*a*) to deal with the eggs surrendered or accounted for in one pool or several pools which shall be operated on such basis and in such manner as it may determine from time to time;

(*b*) to charge its administrative and other costs and disbursements to the pools operated in such proportion as it may determine;

(*c*) to transfer at its own valuation stocks which are unsold at the closing of the pool to the similar pool or pools of the succeeding pool period;

(*d*) to deal with any of its eggs surrendered or accounted for to it without pooling them;

(*e*) at its discretion to grant advances to and to make disbursements on account of any producer or importer who has surrendered eggs to it and to differentiate in its advances, distributions or other payments to or on account of such producer or importer on account either of quality or of the geographical area in which such eggs were produced, or of the situation of the place and the date or period at which such eggs were delivered to it;

(*f*) to deduct from any pool distribution or other payment due to a purchaser any advances or payments made to or on behalf of a producer in terms of the preceding paragraphs;

(*g*) to dispose of any eggs vested in it in any manner or on any terms it may deem best, and for this purpose to enter into contracts for sale, and to accept, in respect of such contracts, promissory notes, bills and other instruments of commerce or exchange;

(*h*) to purchase eggs and to allocate the profits and losses in such transactions between its pool accounts in such manner as it deems best;

(*i*) to import eggs, and to purchase and sell eggs outside the Colony for the purpose of maintaining and developing markets and to allocate the profits and losses on such transactions in its pool accounts in such manner as it may determine;

(*j*) to appoint and employ such persons as it may deem requisite, and to fix the terms and conditions of their appointments;

(*k*) to pay to any person in its employ remuneration according to the conditions of his appointment;

(*l*) to enter into contracts for carrying out any work in connection with the handling, treatment,

transport, storage, grading, sale or export of its eggs or egg products, or any other matter connected with its operations;

(*m*) to borrow money to enable it to carry out the functions aforesaid;

(*n*) to pledge as security for any loan any eggs vested in it and to give any other security which may be available to it;

(*o*) to decline to accept any eggs which it considers to be unsuitable for sale or which, because of quality, transporting facilites or any other reason, it may deem undesirable to accept;

(*p*) to make rules relating to the receipt, handling, grading, treatment, transport, storage and despatch of eggs by producers and by its local agents;

(*q*) to make interim distributions to producers of the proceeds of any sale or sales of eggs after deducting therefrom the amount of any advances or disbursements made to or on behalf of such producers and the estimated cost of administration, provision for bad debts or other costs or losses incurred;

(*r*) in the case of the death or insolvency of any producer or other participant in a pool, to make such final payment to the deceased or insolvent estate before the final closing of the pool as it may consider equitable and is agreed to by the executor or trustee;

(*s*) to require any transport agent to furnish such returns or duplicate consignment notes or such information as it may require in respect of eggs transported by him which were not consigned by or to it;

(*t*) to require any person to furnish in such manner and such form as it may request such information as to his transactions in eggs and the eggs in his possession or under his control;

(*u*) to enter into agreements with any egg-selling organisation in any adjacent territory when it considers that such an agreement would be advantageous;

(*v*) to do all such things as in the opinion of the Minister may be necessary for performing its functions under this Act.

(2) In the exercise of its powers under this section, the Board shall be subject to the approval and direction of the Minister, but the Minister may grant to the Board such general authority to act without reference to him as he may think fit.

Offences.

13. (1) If any person—

(*a*) contravenes or fails to comply with any provision of this Act; or

(*b*) being a purchaser or a producer fails to render true returns as required by this Act or prescribed by this regulation or to pay contributions for which he is liable under this Act;

(*c*) fails to render any information required from him in terms of this Act, or in any such information knowingly makes a false statement;

he shall be guilty of an offence and liable for a first conviction to a fine not exceeding one hundred pounds, or, in default of payment, to imprisonment with or without hard labour for a period not exceeding twelve months, and for a second or subsequent conviction, to a fine not exceeding two hundred pounds, or, in default of payment, to imprisonment with or without hard labour for a period not exceeding two years.

(2) In addition to any penalty which it may inflict, the court convicting an offender may, upon application by the prosecutor, give summary judgment, for the amount of any contribution due and unpaid by him in terms of this Act, and

such judgment shall have the same force and effect and be executed in the same manner as if it had been given in a civil action duly instituted by the Board before such court.

Regulations.

14. The Governor may make regulations not inconsistent with this Act, providing for—

(*a*) the procedure and conduct of the meetings of the Board and of the executive committee;

(*b*) the keeping of the books and other records of the Board, and the auditing thereof;

(*c*) the forms of any documents required for giving effect to the Act or any regulation;

(*d*) the conditions under which the chairman and members of the Board shall hold office, the granting of leave to members of the Board and the appointment of a substitute to hold office during the absence of a member on leave;

(*e*) the submission of returns by such producers, purchasers, importers and other persons as may be determined in such forms as may be prescribed;

(*f*) the classification of eggs accepted by the Board;

(*g*) the registration by the Board of such producers, purchasers and importers as may be determined;

(*h*) the prohibition, regulation or control of the importation into and export from the Colony of eggs or egg products; and

(*i*) generally for carrying out the purposes of the Act.

Freedom of Board from certain Liabilities.

15. No liability shall attach to the Board or to any member thereof for any loss or damage sustained by any person as a result of the *bona fide* exercise or performance by the Board, or a committee thereof or by any servant or agent of the Board, of any power or duty conferred or imposed upon the Board by this Act.

Powers to enter on land and examine stocks and accounts.

16. At all reasonable times any European member of the police, or any person generally or specifically authorised by the Minister, may enter upon the premises of or any land or place occupied by any producer, purchaser or any other person, and may examine all stocks of eggs and egg products and all books, accounts and documents relating thereto, and require an explanation of any entries or documents referring or suspected to refer to transactions in eggs or egg products, and may seize any such books, accounts or documents as may afford evidence of contravention of the Act or of any disregard of the terms of any notice issued under this Act.

The Tsetse-Fly Disease.

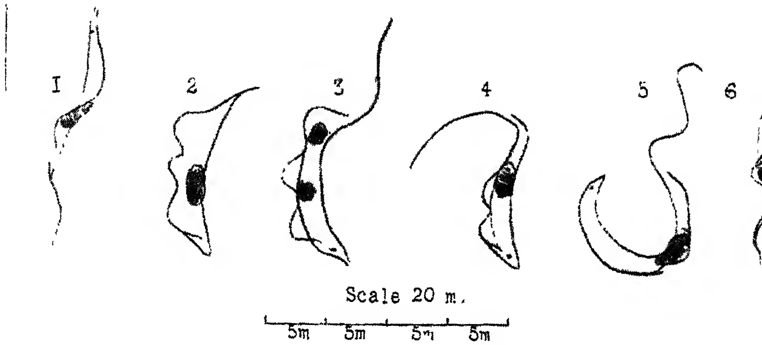
By L. E. W. Bevan, M.R.C.V.S., Beit Research Worker in Trypanosomiasis.

(Paper read before the Rhodesia Scientific Association August, 1936.)

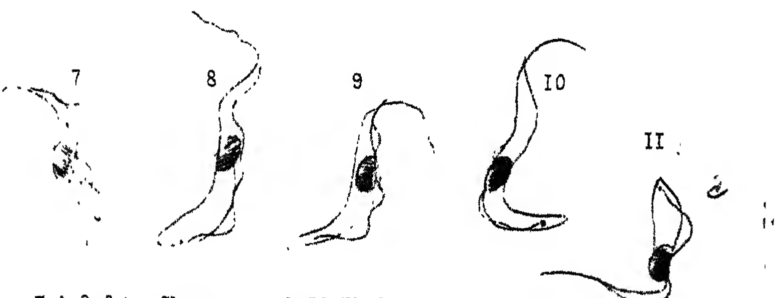
In this paper it is proposed to discuss the disease transmitted by the tsetse fly, which in man is called sleeping sickness, and in animals "tsetse fly disease" or Nagana—a Zulu word meaning, I believe, "to be low or depressed in spirits." The subject is a very comprehensive one, and I can only deal with it in a very cursory manner, and as far as possible from the practical and local aspect.

These diseases are caused by minute animal parasites or protozoa known as trypanosomes, a word coined from the Greek *trupanon*, a borer or gimlet, *soma*, a body, from the manner in which when highly magnified they appear to bore or wriggle their way between the red-blood-cells of their hosts. They are single-celled spindle-shaped bodies about one thousandth part of an inch long, living in the blood and body-tissues of their hosts. Running along one aspect of their body is what is called an undulating membrane with a flagellum along its free edge, sometimes projecting from the anterior extremity like a whip. The different species when stained and examined under the microscope, present different characteristics, but their morphological features cannot be discussed here. It is possible, however, that all trypanosomes have evolved from a common origin.

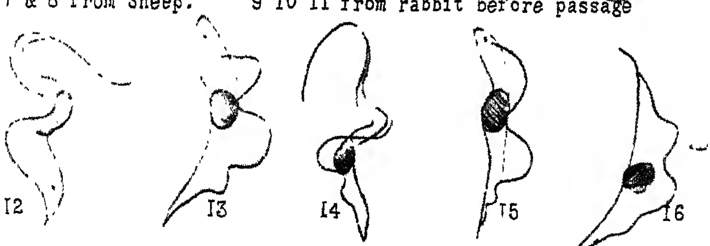
The first trypanosome was discovered by Valentin, of Berne, in 1841, in the blood of a trout, and since then innumerable species have been described in the blood of all sorts of animals. There are trypanosomes of frogs, fishes, rats, mice, bats, birds, reptiles and of mammals large and small. Most of them being blood parasites are transmitted from one animal to another by blood-sucking insects in which they



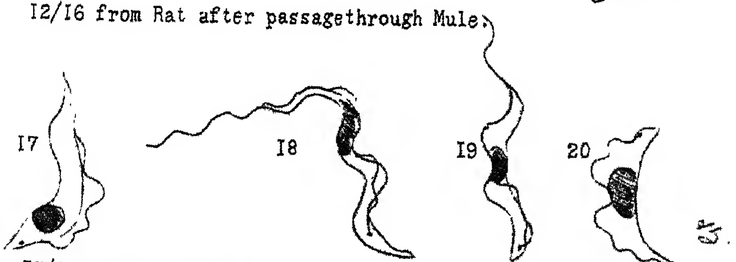
Drawings to scale of trypanosomes recovered from Mule.



7 & 8 from Sheep. 9 I0 II from rabbit before passage



I2/I6 from Rat after passagethrough Mule.



I7/20 from Guineapig.

Copied from original drawings of *T. rhodesiense* by Mr. Bevan in 1909.
Note the posterior nucleated forms.

sometimes become established and undergo part of their cycle of development. Thus *Trypanosoma lewisi*, a parasite of rats, is transmitted by the rat flea, *Trypanosoma melophagium* of sheep is transmitted by the sheep ked, *Trypanosoma cruzi* of man in South America is transmitted by a reduviid bug. Other species, however, are transmitted by contact or other mechanical means, as for example the trypanosome of *dourine*, a disease of equines recently reported from the Cape Colony. In the case of the diseases which it is proposed to discuss to-night they are usually transmitted cyclically by the tsetse fly, but under exceptional conditions mechanically, that is direct from sick to healthy animals without any intermediate development in an invertebrate host.

As a rule these parasites are not harmful to their natural hosts, others are harmless to one species of host but pathogenic to another. Thus, in those parts of Africa where primitive conditions still obtain, the wild animals are infected with various species of trypanosome, although apparently unharmed by them. An equilibrium has become established between "fly," parasite and host enabling them to live in harmony. But when this harmony is disturbed, as by the introduction of unusual hosts to an endemic area, the trypanosome transferred by the tsetse fly from the game to them assumes a deadly virulence. Or again, when "carriers" of trypanosomes move into other tsetse-infected areas their parasites may be transmitted to highly susceptible hosts, with deadly results. An example of this was seen in 1898 when Stanley travelled across Africa with a large number of Congo natives, some of whom were probably "carriers" of sleeping sickness. These mixed with Emin Pasha's people at Wadelai, on the Victoria Nile, and were brought by Sir F. Lugard, for political reasons, to Busoga and Uganda, with the result that their parasites were transmitted to the local inhabitants, and assuming intense virulence caused the death of nearly a quarter of a million natives.

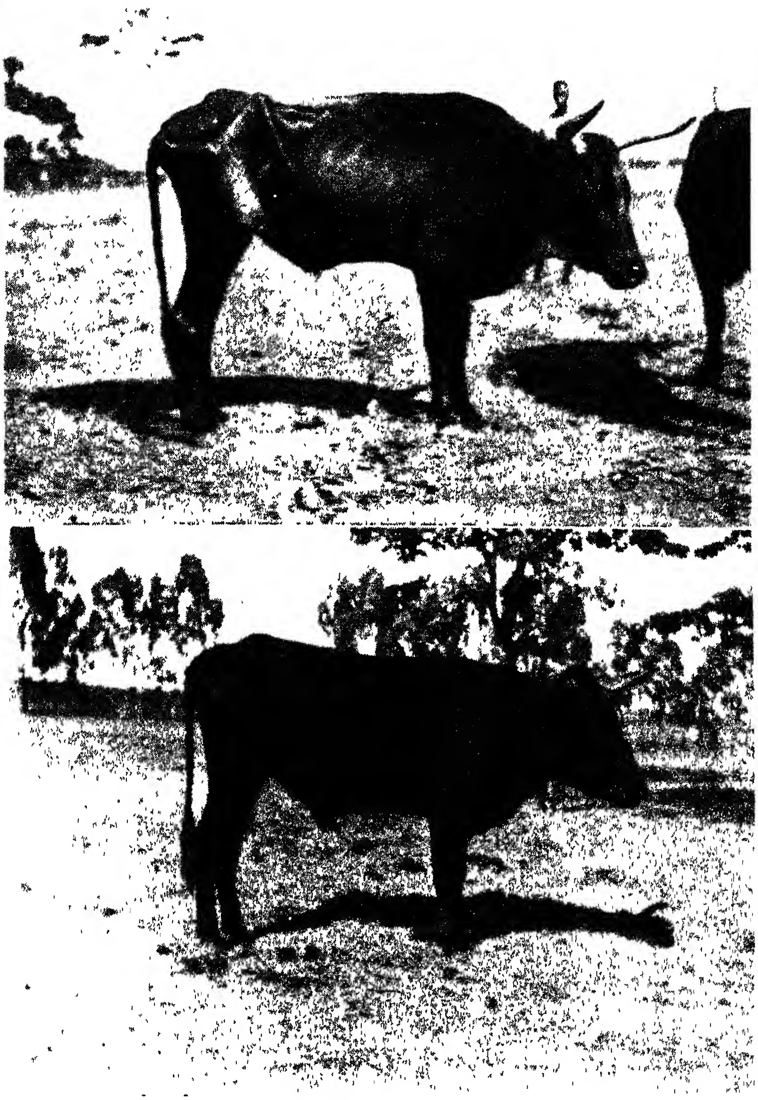
It is probable that throughout the ages the tsetse fly and the diseases transmitted by it have been the chief obstacle to the opening up and beneficial occupation of Equatorial Africa. Although the harmony which I have described existed among the aboriginal inhabitants, newcomers disturbing it paid the

penalty. It no doubt existed in the country which is now Southern Rhodesia when the early hunters and explorers first visited it during the last century. From their records we learn that tsetse fly-infested areas or belts were met with in many parts of the territory north and south of the watershed, and although many of these areas were heavily populated with game, transport animals, cattle and horses, dogs and other domestic stock died of the so-called "fly disease" when taken into them. It is computed that in those days some two-thirds of the country was infested or menaced by the tsetse fly. But after the rinderpest in 1896, for some unknown reason, the "fly" disappeared in all but a few small areas which the Chief Entomologist has been able to locate and which he has designated "survival areas." In these the tsetse persisted and multiplied so rapidly that it soon overflowed into adjoining areas, and during the next forty years again infested some 20,000 square miles of its northern pre-rinderpest habitat. Had its advance not been checked, its extension might have involved a further 30,000 square miles to the south of the present limit. The species of tsetse fly in the northern area is *Glossina morsitans*, Westw., but on the eastern border of the Melsetter district two other species occur, namely, *Glossina pallidipes*, Aust., and *Glossina brevipalpis*, Newst. The habits of these species differ. *G. morsitans* prefers the dry open forest, but *G. pallidipes* and *G. brevipalpis* are associated with thickets and many inhabit dense forest, and are met with in more humid zones than *morsitans*.

It is not my intention to-night to deal with the bionomics of the tsetse fly. This has been most ably and exhaustively done by Mr. Jack, our Chief Entomologist, in papers which he has presented to this Association. I propose to discuss, rather, the diseases transmitted by the "fly" and methods of treating them and conferring immunity against them, and in doing so I must occasionally encroach upon the preserves of the Entomologist.

It had long been suspected that the tsetse fly was associated with disease, but the actual part played by it was not precisely known. Dr. Livingstone, in his "Missionary Travels

Cattle infected with tsetse fly disease, after treatment.



Cattle suffering from tsetse fly disease.

Inoculated ox suffering from deficiency disease. Note the enlarged head.

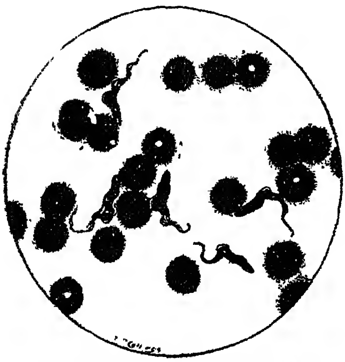
Heifer with enlarged head. Suffering from deficiency disease but not Trypanosomiasis.

and Researches in South Africa," published in 1857, came very near the truth when, having described the symptoms of "fly disease" he wrote:—

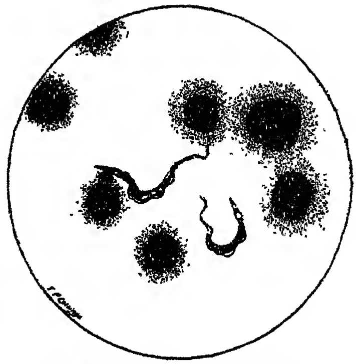
> "These symptoms seem to indicate a poison in the blood, the germ of which enters when the proboscis is inserted to draw blood. The poison germ, contained in a bulb at the root of the proboscis, seems capable. although very minute in quantity, of reproducing itself."

As this was written some twenty years before Pasteur, Koch and others had demonstrated the microbial origin of disease, it shows the keenness of Livingstone's powers of observation and deduction. It was not until 1895, however, that David Bruce carried out his epoch-making researches on tsetse fly diseases, or Nagana, in Zululand, and found that it was caused by the entrance into the blood of a minute parasite which multiplied there. He also proved that this parasite existed in the blood of many animals and that it is conveyed from animal to animal by the tsetse fly. He did not demonstrate, however, how this transmission took place, and it was not until 1909 that Kleine discovered that the trypanosome when taken up by the tsetse undergoes a cycle of development in it, so that it is only after an interval of some twenty days that the fly becomes infective. Thereafter. every time that fly feeds it ejects trypanosomes into its host. And as the tsetse fly is essentially a blood-feeder and requires to feed every few days and as it can live for as long as ten to twelve weeks, a single infective "fly" can do a lot of damage. Tsetse flies are not always in swarms like bees, and on farms where cattle are dying from trypanosomiasis it is not always possible to prove the presence of the "fly." This has lead to a lot of confusion in the past, but in Southern Rhodesia where trypanosomiasis occur it is always wise to suspect the tsetse fly.

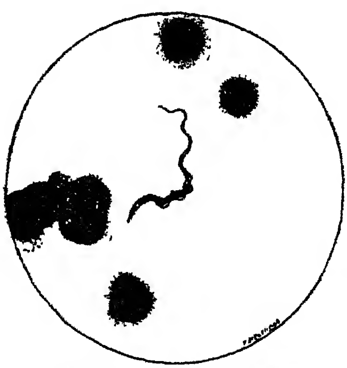
As far as I can ascertain, in Southern Rhodesia, although it was known that in tsetse infested areas domestic stock died, no steps were taken to control either the "fly" or the disease until 1905, when some investigations were made in the Hartley district. Attempts were made to locate and identify the "fly" and the trypanosomes it transmitted, to study the disease and to discover a remedy. These were carried out in a desultory



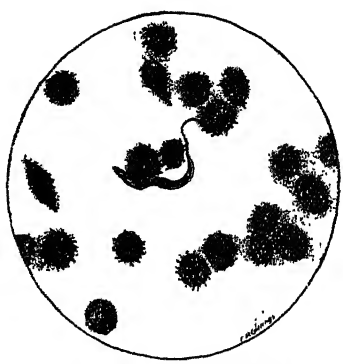
HÆMATOZOA IN THE BLOOD OF THE DOG.



HÆMATOZOA IN THE BLOOD OF THE HORSE.



HÆMATOZOA IN THE BLOOD OF THE HORSE



HÆMATOZOA IN THE BLOOD OF THE COW.

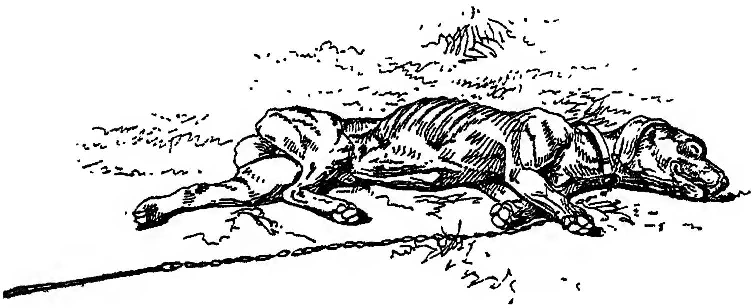
All magnified 1,000 times

Reproduced from Bruce's Report on the Tsetse Fly Disease or Nagana, 1896.

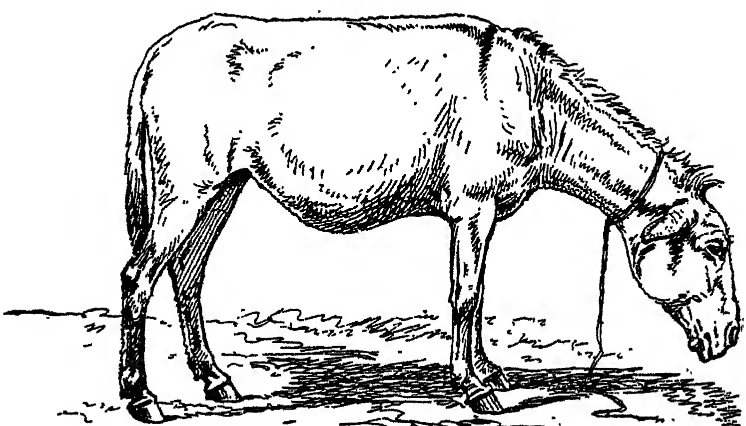
manner as part of the routine duties of a District Veterinary Surgeon. But in 1908 the matter became more serious because Montgomery and Kinghorn, working in Northern Rhodesia, propounded the theory that the trypanosomiasis of cattle there might be transmitted by blood-sucking insects other than the tsetse fly. This caused some perturbation in this country where blood-sucking flies were ubiquitous and not restricted to certain well defined areas as was the tsetse fly. Moreover, large numbers of cattle were frequently being imported from the north and it was feared that they might bring an undesirable strain of trypanosome with them. As a member of the Veterinary Department I was deputed to investigate the matter, and in an "Interim Report on the Animal Trypanosomiases of Southern Rhodesia," appearing in the *Agricultural Journal* of February, 1910, I published what I believe was the first description of the disease in this country, and endeavoured to identify the trypanosomes which caused it. I could find no proof of the suspicion that infection was commonly transmitted by flies other than the tsetse or by mechanical means, and the restrictions based upon Montgomery's hypothesis were relaxed. No doubt under certain conditions mechanical transmission may occur as it does in other countries, but in Southern Rhodesia such conditions are so rare as to be of little practical importance. Most outbreaks of trypanosomiasis here originate from infection by the tsetse, although it may not always be easy to find.

It must be remembered that in "fly" areas the wild animals harbour trypanosomes although apparently unharmed by them. They have been found in buffalo, bushbuck, duiker, eland, elephant, hartebeest, hyænia, hyrax, koodoo, impala, oribi, puku, reedbuck, roan, sable, serval, situtunga, steinbok, warthog, waterbuck, wildebeeste, and other animals. It is significant to relate that the baboon appears to be entirely resistant to infection. However, in a "fly" area there is an abundant supply of trypanosomes to be taken up by the tsetse which, incidently, is essentially a blood feeder and requires a feed of blood every two or three days.

Owing to Montgomery and Kinghorn's theory it became necessary to determine what were the common species of trypanosomes in animals in this country, because different species



Dog suffering from fly disease or Nagana. Reproduced from Bruce's Report on the Tsetse Fly Disease or Nagana, 1896.



Donkey suffering from fly disease or Nagana. Reproduced from Bruce's Report on the Tsetse Fly Disease or Nagana, 1896.

of trypanosomes behave in different ways. Some are transmitted mechanically and others are not. Some respond to one drug and some to another. Three principle trypanosomes were encountered in animals:—

1. *T. brucei*, named after Bruce, occasionally met with in equines and dogs but rarely in cattle.
2. *T. vivax*, so called because of the rapidity of its movements, met with in cattle. It seems to be more common to-day than it was some years ago.
3. A small trypanosome commonly met with in cattle, equines, dogs, and sometimes in sheep. I was unable to identify this trypanosome because it appeared to differ in minor respects from that described by Montgomery and Kinghorn; it also differed from a similar small trypanosome known as *Trypanosoma congolense* which is met with in other parts of Africa, and which in Zanzibar is transmitted by other means than the tsetse fly, which is not present there. It was eventually decided to call it *Trypanosoma pecorum*, which was non-committal but descriptive.

Recent experiments have confirmed the suspicion that it is *not* identical with *Trypanosoma congolense*. You may say "What's in a name?" but I can assure you that in the case of trypanosomes a name is of considerable academic and, withal, practical importance, as you will now see.

In 1909 this fact was well demonstrated. In November of that year there arrived in Hartley from the north, a European (W.A.) in whose blood Dr. A. Mackenzie found a trypanosome. From this man I obtained blood which I inoculated into small laboratory animals, sheep, cattle and mules. In all of these a most acute form of trypanosomiasis developed, and I contributed a description of the parasite and the animal reactions caused by it to the *Journal of Comparative Pathology and Therapeutics*. I did not venture to give the parasite a name, because the circumstances in which it occurred were so exceptional that I did not feel justified in regarding it as any of the common trypanosomes of man or animals. I could not regard it as *T. gambiense*, the cause of sleeping sickness, because the common vector of that disease

is *Glossina palpalis*, a tsetse fly never met with in Southern Rhodesia or that part of Northern Rhodesia in which W.A. had travelled. Nor could it be *Trypanosoma brucei*, which was not considered to be infective to man. W.A., however, was hurried off to England and Stephens and Fantham studied his trypanosome and hurriedly declared it to be a new species, to which they gave the unfortunate name *Trypanosoma rhodesiense*. The discovery of a human trypanosome transmissible by *Glossina morsitans*, the common tsetse fly of this country, was alarming. It was feared that infection might spread throughout our tsetse fly areas as sleeping sickness has spread through Uganda. Fortunately it did not do so. During the past twenty-seven years there have only been seven European cases and 49 native cases in Southern Rhodesia, although farther north there have been innumerable cases of what is unfortunately called "rhodesiense infection." But "What's in a name?" Since the first discovery of this trypanosome the controversy has waged between scientific men as to whether the trypanosome so named was a species *sui generis*, or the old-fashioned *T. gambiense* transmitted by an unusual "fly," or the common trypanosome of animals, *T. brucei*, accommodated to man. These scientists became so serious about it that Taute, a German doctor in German East Africa, inoculated himself and 120 natives with *T. brucei*, from horses and mules, but none became infected.

Corson more recently fed *G. morsitans* on a cow infected with *T. brucei* and then upon a guinea pig and himself. The guinea pig became infected but he did not. Later he fed the flies upon Smith and a guinea pig and again the guinea pig only became infected. He also sought to ascertain whether *T. rhodesiense* could become *T. brucei* by passage through animals. He obtained a strain of *T. rhodesiense* from a native and for 19 months passed it through sheep and then by *G. morsitans* and *pallidipes* to guinea pigs. From one guinea pig he inoculated himself and became infected. Even to-day the problem has not been solved.

Recently a somewhat significant discovery has been made. Dr. Blair, of the Southern Rhodesia Medical Trypanosomiasis Survey, visited Gowe, a village on the banks of the Umniati River, where certain Europeans and natives were suspected

to have contracted sleeping sickness, and found there an old native called "Kahondera," comparatively healthy as old natives go, but with trypanosomes in his blood. "Kahondera" was apparently "tolerant" to his infection, but when I inoculated laboratory animals with his blood they became infected and rapidly died. Their trypanosomes appeared to be identical with those I described in animals infected with W.A.'s blood in 1909 and natives' blood in 1913. Subsequently Kahondera's son was also found to be infected. How did they become infected and how did they become "tolerant" to infection, and what was the species of trypanosome in them? A remarkable coincidence was the association between cases of sleeping sickness and the neighbourhood of Gowe. The infected area was apparently very limited. Natives from the surrounding tsetse infested country were apparently free from infection, but were not resistant, because they became infected after visiting Gowe. What was there peculiar about the Gowe area? On studying the Chief Entomologist's maps it was found that Gowe was one of those areas called by him "survival areas" where the tsetse fly had persisted after the rinderpest epizootic of 1896. It was one of those rare places where natives could have been regularly bitten by tsetse flies from their earliest days—just as the game are bitten and infected in the tsetse fly belts. But the parasite with which "Kahondera" was infected could not have been the same parasite as that found in game, although it had the same appearance, because although infected game are common in tsetse fly areas, and dogs and donkeys become infected with *T. brucei*, human beings do not become infected, except in the vicinity of Gowe and another "survival area" near Manzituba Vlei, where human cases of infection were found in 1913. The parasite of which Kahondera was a "carrier," therefore, would appear to be a trypanosome of man not commonly infective to animals. Dogs tied up at Gowe and well bitten, and cattle grazing in the vicinity did not become infected with the same trypanosome but with the common animal trypanosome *T. pecorum*. I suggest that the human trypanosome of this country is rare and probably restricted to well defined areas; that its usual method of transmission is by *Glossina morsitans* from man to man and not from game to man as was originally feared. Whether this applies to the so-called

T. rhodesiense in other countries, I cannot venture to say, but as far as this country is concerned it is a comforting reflection and suggests that if human "carriers" are removed from endemic areas to districts where there are no tsetse, the strain of trypanosome which is infective to man will die out and Rhodesia will be free from the stigma of being the home of human trypanosomiasis—unless introduced from neighbouring territories.

This brings me to the subject of immunity in trypanosomiasis, a subject of considerable importance, because it may afford a solution to the tsetse fly problem. At present the measures adopted for the control of the disease trypanosomiasis are chiefly directed towards the control of the "fly." I suggest that if a method could be found of protecting man and animals against the disease the tsetse fly would be rendered innocuous. It will, I fear, be many years before the tsetse fly is brought under control. Mr. F. C. Swynnerton, Director of Tsetse Research in Tanganyika Territory, who recently addressed the Southern Rhodesian Trypanosomiasis Committee, admitted that the entomologists could not claim complete success until the last tsetse fly had been eliminated—a consummation which under the conditions obtaining in Central Africa, appears to be somewhat remote. In the meantime some alternative method of dealing with the problem appears desirable.

In veterinary science there are many diseases which are controlled by rendering animals resistant to them. To take local examples we may quote quarter evil and anthrax. Since we cannot remove the bacteria which cause these diseases we render their hosts immune against them. Or red-water of cattle, which is transmitted by the tick. As it will be many years before the last "blue tick" is eliminated, we deliberately infect cattle with a mild form of the disease, recovery from which renders them resistant to natural infection by ticks.

As Beit Research Worker my efforts have been in this direction. I have sought to render animals resistant to trypanosomiasis. The idea appears quite feasible. In the first place it is the manner in which nature herself deals with the problem. As we have seen, the wild animals in "fly" areas are resistant to infection. Similarly in some parts of

Africa the native inhabitants are "tolerant," and even the cattle, although "carriers" of infection, are "tolerant" until adverse conditions break down their resistance. I carried out some experiments hoping to ascertain how this "tolerance," or "premunity," was brought about. I decided to observe the effects of infection upon young laboratory animals. I had to use young rats and mice which, as you know, yield litters of four to eight young. But I encountered many difficulties. As often as not when I handled the young, the mother devoured or destroyed them. When a mother became sick she would thin out the litter by destroying those for which she could not find nourishment. Later, the strong young ones devoured the weak, and later still, the males would fight and destroy each other. This, I suggest, may occur among carnivora in nature. Nevertheless, some interesting facts came to light. Contrary to the observations of others, I found that an infected mother did not give birth to infected young, nor did her young become infected by drinking her milk, nor from her or one another by cohabitation or coitus. Healthy mothers eating infected young did not become infected, nor did cannibal rats eating infected rats become infected. In short, I only succeeded in infecting young rats by inoculating them by the syringe with infected material. They then became infected just in the same way as older rats. As the disease progressed in them, a large percentage died or were killed off. Eventually only the strongest survived. Some of these recovered from the disease; the parasite disappeared from them and the infection died out. But, later, these recovered animals if re-inoculated proved susceptible and died of infection. But if during the currency of the first infection the young animals were re-infected, they developed a resistance or "tolerance" and remained apparently healthy but still carrying trypanosomes. I have mice and rats at the laboratory which, although infected, have lived for over a year.

From this it would appear that the young possess some innate powers of resistance which die out as they grow older. This resistance is dependent upon re-infection; in other words the maintenance of tolerance is dependent upon the persistence of infection. In Nature this would occur in the heavily infested tsetse fly areas and hence, I submit, the "tolerance" of man and animals born in such areas. The

process is comparable to that which occurs in redwater or piroplasmosis of cattle, and other protozoal diseases. Possibly it is what happens in malaria of man. In research work it is often wise to ask oneself "How does Nature do it?" And it is often profitable to follow Nature's methods.

I must now digress for a moment to discuss the methods of treating the tsetse fly disease, a digression, however, which will bring us back to the subject of immunity. Among other things investigated by Bruce was the treatment of the disease. He tried numerous drugs and sera without complete success. One of the most hopeful remedies was arsenic, which undoubtedly exerted some effect upon the trypanosome studied in Zululand. It would, in fact, cause the temporary disappearance of the parasite from the peripheral blood, but unless doses were given so large as to be dangerous to the treated animal, the parasite, after an interval, returned. With repeated doses it again disappeared, but returned after shorter intervals after each lose. In course of time it became arsenic resistant. The trypanosome cannot only develop a resistance to drugs but to sera. It is possible to produce drug-resistant strains of trypanosomes. Thus if one treats a rat suffering from trypanosomiasis with sub-curative quantities of arsenic, the trypanosomes become arsenic-resistant; and if one inoculates these trypanosomes into another rat their descendants remain arsenic-fast. But if one inoculates them from the rat into another species of animal, as for example, a guinea pig or mouse, they lose their arsenic-resistance. I merely mention this to show how complicated is the chemotherapy of trypanosomiasis.

In this country we were particularly fortunate when in 1909 I found that potassium antimonyl tartrate was a specific remedy for the local trypanosomiasis in cattle. It is the treatment mentioned in the Interim Report I referred to. It has been used not only in this country with considerable success, but in other parts of Africa. It is indeed the "sheet-anchor" of treatment of trypanosomiasis of cattle caused by *T. congolense* in most of the African colonies. This treatment has stood the test of time, and we find in the Annual Report of the Director of Veterinary Research for the year 1935 that as the result of a detailed experiment he has drawn

the conclusion that "In the Golden Valley 'fly' area it is quite practicable to maintain cattle in a fit condition for work, milk production and breeding, provided a proper system of management is adopted and the recommendations of the Department concerning the detection and treatment of cases of trypanosomiasis are practised," which confirms the experience of the past twenty-five years in this and other countries.

A serious and practical difficulty in connection with the antimony treatment is the fact that large quantities of the solution must be injected into a vein, for if any of it escapes under the skin, abscesses or necrosis and sloughs may occur. To avoid this the animal has to be thrown and secured, and this rough handling is in itself harmful to sick animals.

It was desirable that a more simple method should be found, and this was provided by Messrs. Bayer, the German chemists, in the form of Antimosan, an antimony derivative which can be injected subcutaneously without the difficulty associated with the tartar emetic. But it is too expensive for general use.

When the antimony treatment was first adopted in Southern Rhodesia it was applied only to those animals which were obviously sick, and it frequently happened that these were so thin and weak that recovery was delayed until a plentiful supply of green grass during the summer rains supplied the necessary food and nourishment which their owners had denied them during the winter drought. Transport oxen also were frequently returned to the yoke long before recovery was complete, and deaths from starvation and exhaustion rather than trypanosomiasis were recorded as evidence of the failure of the treatment. It was therefore decided to recommend that, in herds or spans liable to infection, treatment should commence as soon as the animals manifested any of the characteristics symptoms of the disease. Owners soon became remarkably adept at detecting such animals, and not uncommonly confirmed their diagnosis by referring blood smears to the laboratory, where they were examined free of charge. On certain farms and estates where, owing to the presence of the tsetse fly, animals were in constant danger of infection, it was decided to treat all animals periodically in the hope of

arresting the disease in the newly-infected during its early stages. On one tobacco plantation, where the section managers had lost most of their cattle used for ploughing and cultivating, it was decided to re-stock and adopt this principle, with the result that for some years as many as three hundred and sixty head were treated once a month as a regular routine. The mortality was thus reduced to one or two animals which had died as the result of accident. The work entailed in this process, however, was considerable, and an official had to be detailed to assist. It was only on estates belonging to wealthy owners or companies that a sufficient staff of labour, native and European, existed to permit of this addition to the ordinary farm routine, already sufficiently onerous for the small farmer or transport rider.

Realising the value of this method, but the difficulties associated with it, the writer sought to improve it, and was guided in his efforts by certain observations which in the course of his somewhat lengthy experience had appeared to have a practical bearing upon the problem. The first was the well-known fact that wild animals, living in tsetse-infected areas, harboured the trypanosome although unharmed by it, and were apparently resistant to re-infection. The second, that infected cattle, which recovered as the result of treatment, similarly continued to "carry" the trypanosome, and appeared to be remarkably resistant to re-infection. Time after time it was found that treated animals lived where untreated animals died. Thirdly, it was found that large doses of the drug were unnecessary, and that recoveries occurred and treatment appeared to be just as successful when circumstances, such as a shortage of labour, long distances to travel, and so on, prevented the frequent treatment with the drug. It was realised that success had often followed where only one, two or three injections had been possible.

It was upon the basis of these considerations that it was decided to endeavour to devise a method of inoculating cattle against trypanosomiasis comparable to that employed in the protection of imported stock against piroplasmosis, for it was felt that if cattle could be inoculated with a known virus and be appropriately treated before natural exposure in the "fly" areas, the necessity for monthly treatment in the hope

of catching the cases newly infected during the intervals, with all the labour and inconvenience involved, would be done away with. In other words, it was thought that if the artificially infected animals did not suffer more severely than naturally infected ones, and responded as satisfactorily to treatment, and thereafter exhibited as great a resistance to natural re-infection, the immediate risk would be preferable to the prolonged anxiety associated with the risk of natural infection.

To this end experiments were carried out with a view to establishing a suitable virus, that is, a strain of *T. pecorum* having

(1) a more or less defined period of incubation;

(2) a period when the greatest number of trypanosomes were present in the peripheral blood;

(3) a marked response to antimony treatment.

It was thought, as the result of experience, that successful treatment depended chiefly upon careful "timing" based upon the development of the parasite and its appearance in the blood stream. This supposition proved to be correct.

When this method was first suggested it was severely and somewhat unfairly criticised before a real test had been carried out. It was objected that although an animal might be rendered tolerant to one strain of trypanosome it might not prove resistant to another strain of the same species. One of the critics subsequently carried out some experiments to test the matter and found that a different strain would merely cause in cattle properly nourished, a transient anaemia. This has been my own experience. Others said that as Nature had failed to render domestic animals resistant it was unlikely that man could do so. As a matter of fact, Nature has rendered domestic animals in some countries tolerant in the same manner as the game. For example, it has been found that in Nigeria many cattle "carry" the trypanosome in a latent form and its presence is only detected when the animal is suffering from rinderpest naturally acquired or the result of inoculation. The same occurs in Dahomey and the Gold Coast. Also in the Kaolib Hills of the Juba Province, where man, tsetse flies and domestic stock live together in blissful

harmony, although the latter are trypanosome "carriers." As the result of my paper published in the Transactions of the Royal Society of Tropical Medicine and Hygiene in August, 1928, evidence has been obtained from many parts of Africa, of this naturally acquired "tolerance" of domestic stock. My idea, therefore, was not as "far-fetched" as my critics would have had us suppose. The greatest objections against the method, however, are not those foretold by its original critics, but others which have come to light as the result of practical experience.

Between 1928 and 1931 two spans of oxen were inoculated by the method suggested and were exposed to natural infection. The results were unsatisfactory. The resistance of the animals against trypanasomiasis broke down for the following reasons:—

1. The animal became infected with species of trypanosomes other than those with which they had been inoculated, *e.g.*, *T. vivax*.
2. They contracted other diseases in addition to trypanosomiasis, *e.g.*, redwater, gall-sickness and verminosis.
3. They suffered from nutritional diseases, starvation (lack of food and water—a common feature of "fly" areas), avitaminosis and mineral deficiencies.

It is obvious that if an inoculation process based upon a condition of "tolerance" is to be successful, adverse conditions so common in "fly areas," must be guarded against. Preventive and curative measures must be devised against the diseases I have enumerated, and many others; the dietetic deficiencies must be provided. I am satisfied that mineral deficiencies are factors of enormous importance. The soils and grasses of this country, particularly in the "fly" areas, are notably deficient in various salts essential to good health. These differ in different geological formations. To determine which they are is a branch of research of the greatest importance to man and beast. In short, before an immunity based on "tolerance" can be successful the methods of animal husbandry in this country will have to be revolutionised. To emphasise my point I should like to tell you or a disease of cattle in Nigeria called "mudu" which, I believe, means licking. Animals suffering from trypanosomiasis develop a craving and are con-

stantly licking the soil. The "licking" may be arrested in two ways, either by curing the trypanosomiasis with antimony, or supplying the animals with common salt. This is a practical example of the effect of mineral deficiency upon the course of a latent trypanosomiasis. My friend, Mr. Lombard, for many years in charge of cattle in Portuguese East Africa, and who was able to keep thousands alive in the "fly" areas by antimony treatment, tells me many interesting things. He assures me that the treated animals did best which had access to the mineral-pans by the river side. He tells me another important thing, namely, that treated animals did best in areas where the "fly" was densest. As young animals they become infected and passed through a period of "set-back," but those that recovered developed into healthy animals and supplied him with his best trek oxen. They could come and go anywhere, whereas those animals born in an area where "flies" were only occasionally present would develop the disease, and although they recovered under treatment, their "tolerance" did not last. Later, when exposed to heavy infection they again developed the disease in acute form. His practical experience confirms my deductions from my experiments with young rats, namely, that the maintenance of tolerance is dependent upon the persistence and degree of re-infection. Duke, in Uganda, has recently made the same observation in connection with the duration of immunity in natives treated with Bayer 205 against sleeping sickness.

However, an immunity based upon "tolerance," although useful up to a point, is not the final solution. It is unsatisfactory in that it may break down under adverse conditions; also "tolerant" animals are "carriers" and a potential source of trypanosomes to tsetse fly. What is required is a firm or lasting sterile immunity, that is, an immunity free from the presence of the parasite in the immune animal—such an immunity as many of us have acquired as the result of vaccination against small-pox. We did not thereby become carriers of the disease, but for a long period we were protected against it.

But unfortunately a method of creating a firm sterile immunity against protozoal diseases has not been discovered. If it could be accomplished, think what it would mean. If

man could be rendered permanently resistant to malaria. cattle to redwater and gall-sickness, man and animals to trypanosomiasis, the future of Central Africa would be assured. But there are many difficulties to overcome, many discoveries to be made. And with the best intentions in the world, scientists cannot turn out discoveries and inventions to order like sausages from a machine. Such an immunity can be created against bacterial diseases, but bacteria are vegetable parasites which can be grown in a flask, whereas trypanosomes are animal parasites and can only be grown in the animal body. Vaccines can be prepared against bacteria and their products. Thus in the case of quarter evil, a well-known bacterial disease, cattle can be rendered resistant by inoculating them (*a*) with the bacteria killed by heat, (*b*) with the toxins produced by the bacteria in flasks of medium and rendered free of bacteria by filtration, or (*c*) by aggressins, which are the products of the bacteria in the infected animal, rendered innocuous. It is possible, also, to produce immunity against virus diseases by artificial means. But the only form of immunity against protozoal diseases results from recovery from them and is an "immunity tolerance" which, as I have said, is not all that can be desired. There is reason to believe, however, that a solution of the problem is in sight.

Great progress has been made in recent years in the treatment of sleeping sickness of man by means of Bayer 205, Tryparsamide and other mysterious organic compounds. If cases are taken early there is every prospect of cure. But 205 exerts in addition a protective effect. Duke states that "A dose of 2.0 gm of Bayer 205 administered to an adult may be expected to confer protection against *T. gambiense* and *T. rhodesiense* for at least three months. The protection may last much longer. One volunteer resisted infection by tsetse for 327 days after he had received 1.0 gm of Bayer 205." And it is in connection with this volunteer that he says:—". . . . a consideration of the behaviour of the volunteer Z.F. suggests that frequently repeated inoculation of living trypanosomes during the three months immediately following the administration of Bayer 205 lead to the establishment of a more prolonged immunity than that conferred by the drug alone without such frequent exposures to infection. If this is true, then

the more intensive the exposure in nature to infected tsetse the greater the benefit derived from the prophylactic." Bayer 205 is effective against *T. brucei*, but less so against the small trypanosome of animals, called *T. congolense*. The discovery of this mysterious drug which has a very complicated formula, but contains no arsenic or antimony, revolutionised the treatment of "sleeping sickness."

The Germans, who as chemists are pre-eminent, and who take the most profound interest in tropical diseases, have since discovered a similar drug, Surfen C., which is said to be equally effective against *T. congolense*, but although they kindly sent me three packing cases full of the drug, and although for two years I carried out careful tests with it, hoping that it would be the solution of my problems, I did not obtain successful results with it. Apparently our local trypanosome has different drug-affinities to the *T. congolense* of other parts of Africa. If you remember, some twenty-five years ago I thought it was different and decided to call it *Trypanosoma pecorum*. Recent events appear to confirm my earlier impression.

There are to-day thousands of alleged remedies for trypanosomiasis waiting to be tested. The preliminary experiments are being carried out in Europe upon laboratory animals and laboratory strains of trypanosomes; the final tests have to be performed on natural cases in the field. These tests take time and cost money. It is estimated that to carry out even the preliminary experimens with any hopeful remedy occupies at least 500 working hours and requires many dozens of animals. But recent progress in trypanotherapy has been so rapid that complete success is even now in sight. The fact that protection as well as cure can be effected is of the greatest importance.

This brings me to the part of my paper with which I should have commenced, namely, the *present position* in regard to trypanosomiasis in Central Africa generally.

Let us commence with Southern Rhodesia. The Government of this country has during the past few years spent some £50,000 in tsetse control measures. This year it is allocating about £7,000 for this purpose. Unfortunately this is recur-

rent expenditure, for if the measures are relaxed the "fly" may return to the areas from which it has been evicted. There are same who say "Why worry; the "fly" country is useless; why not fence and forget it?"

It is true that much of it appears to be worthless from the agricultural point of view. But who can say to-day that any soil is worthless? By modern methods of scientific agriculture even the most "hungry" soil can be made to "blossom as the rose." And who can say what minerals these northern areas contain? Certainly there is an abundance of coal in them, and this may not always be locked up. At any rate, Rhodesians are proud of their country and will not readily consent to a third of it being surrendered without an effort to the tsetse fly.

The Government has also instituted a Medical Survey of the tsetse areas, and has paid the working expenses of my own research.

Some two years ago, at the instigation of our Prime Minister, who we are proud to say is first and foremost a scientist, the Southern Rhodesian Trypanosomiasis Committee and its associated Trypanosomiasis Bureau was created. The former with Mr. Huggins as President and Dr. Brain as Chairman, was made up of experts in the various branches of science involved in the very comprehensive study of trypanosomiasis. The committee has proved helpful, for although it has not itself been able to carry out any research work, it has investigated and reported upon certain matters of importance, such as the destruction of game as a means of controlling the tsetse fly, the African Reclamation Scheme, and similar subjects. Members of the committee who, incidently, give their services, have contributed valuable papers, and a team spirit has been engendered which is "all to the good." I have received great assistance from them in my work.

Recently at an official Conference at which trypanosomiasis was discussed, Dr. Brain was elected to the chair of the Trypanosomiasis Committee, contributed to the success of the proceedings. Delegates from Northern Rhodesia and Nyasaland were present and expressed in the form of a resolution the wish that the scope of the Southern Rhodesia Trypanoso-

miasis Committee and Bureau might be extended to include Northern Rhodesia and Nyasaland. Our committee took this suggestion seriously, and with the approval of our Prime Minister the old Tobacco Research Station at Lower Hillside was rendered suitable for the carrying out of the suggested scheme of co-operation. There, however, as far as I know, the matter rests. With regard to the Bureau, of which I am honorary secretary, some 400 scientists in many parts of the world, libraries, laboratories and other institutions have been circularised, and many have contributed most valuable literature and helpful advice.

As far as Southern Rhodesia is concerned, it appears to me that the position is very hopeful. If endemic foci of human trypanosomiasis are detected and "carriers" removed to fly-free areas, and the introduction of latent cases from without is prevented; and if domestic stock are suitably treated and nourished, trypanosomiasis of man and animals can be effectively controlled.

I submit that, in the matter of trypasonomiasis, Southern Rhodesia has played an important part and set a good example to her neighbours. But the tsetse fly problem is not one which she can solve alone. The problem is so comprehensive that co-operation and collaboration between her and other colonies and other workers is essential.

With regard to our neighbours. It has been recorded by the Director of Animal Health for Northern Rhodesia in his Annual Report for 1934, that at least five-eights of that territory are infested with tsetse fly; and at the Conference which I have referred to, it was revealed that sleeping sickness was prevalent, although its distribution and extent was not known. A large part of Nyasaland is also infected by the tsetse fly and cases of sleeping sickness occur. In the Annual Report of the Medical Officer for that territory it states: "Trypanosomiasis of man is not a serious problem at present, though the increase is to be noted. Thirty-two cases were reported; the total for the previous four years together was only 25." On the other hand, in a recent article in the *British Medical Journal*, Dr. W. A. Lamborn, Medical Entomologist of the Nyasaland Protectorate, suggests that man may act as a

reservoir of *T. rhodesiense* infection and may be a source of danger to others in tsetse fly areas," confirming my own observations. He gives examples, and in his conclusion states:—"Its importance lies in the fact that the spread of sleeping sickness is, in all probability, mainly due to the movements of human carriers of a strain of trypanosome which, while not immediately pathogenic, may become so after more than one passage through man." He says:—"It emphasises the need of examination of the whole population when sleeping sickness arises apparently *de novo*. The investigation should include the examination of the blood of even the apparently healthy and of material obtained by puncture of the lymph glands." Unfortunately this is not at present a reliable method of diagnosing the disease in "latent" cases, and "carriers," who often appear to be in perfect health, and may be overlooked.

In a recent report by the Tsetse Fly Committee of the Economic Advisory Council, emphasis is placed upon the danger associated with the movement of natives travelling from one country to another in search of employment. There appears to be a grave risk of the re-introduction of sleeping sickness into this territory, even should we get rid of it.

With regard to Portuguese East Africa, large areas are infested with tsetse fly, from the North right down to our Melsetter border; and sleeping sickness is prevalent. The figures we have obtained relate to hospital treated cases, but these, of course, give no indication of the true state of affairs. In the light of recent knowledge it is not so much the acute cases which rapidly succumb but the "carriers" from endemic foci which are the chief danger.

Thus we see Southern Rhodesia is surrounded by tsetse-infested areas which are a potential source of danger to her.

Further North nearly the whole of Central Africa is held ransom by the tsetse, and the development of valuable areas of territory is rendered impossible. Cattle for transport cannot live unless treated with antimony, and it is impossible to keep cows for milk and other necessary domestic stock. Thus mining and agricultural development is out of the question. Also, the

deadly sleeping sickness causes an enormous mortality. In four reports taken haphazard we find the following figures relating to natives under treatment:—

French West Africa	50,000
Belgian Congo	15,000
Nigeria	48,000
Gold Coast	10,000
	123,000

In view of the well-known disinclination of natives to submit to the white man's treatment, these figures probably represent but a small proportion of the infected. For humanitarian reasons, therefore, research in trypanosomiasis is very desirable.

In a report of the East African Sub-Committee of the Tsetse Fly Committee of the Economic Advisory Council published in July, 1935, attention is drawn to the very serious obstacle which the trypanosomiasis of man and animals constitute to the prosperous development of the British Colonies, Protectorates and Mandated Territories in Central and Eastern Africa. The committee, while deploring the reduction in research establishments and personnel, advocates the more vigorous prosecution of research in trypanosomiasis. One can confidently assert that without it the progress and development of the greater part of Central Africa will be as slow in the future as it has been in the past.

Southern Rhodesia Weather Bureau.

AUGUST, 1936.

Pressure.—Mean monthly pressure was generally slightly above normal, it was higher in the south than the north.

Temperature.—Mean monthly temperature was generally below normal.

Rainfall.—Light showers were recorded at most stations during the last few days of the month.

AUGUST, 1936.

Station.	Pressure Millibars, 8.30 a.m. Mean.	Pressure Normal.	Temperature in Stevenson Screen °F. Absolute Max.	Absolute Min.	Mean Max.	Mean Min.	Mean ½ Max. Min.	Mean Normal.	Mean Dry Bulb.	Mean Wet Bulb.	Rel. Hum. %	Dew Point F.	Cloud Amt. 0-10	Precipitation Ins.	Precipitation Normal	Precipitation No. of Days	Altitude (Feet)
Angus Ranch... ...	...	...	84	45	77.1	51.2	64.2	64.2	61.2	57.1	78	54	...	0 02	0.02	1	...
Beitbridge...	971.4	...	88	42	79.8	51.5	65.7	...	62.4	54.1	58	48	2.6	0 00	0.09	...	1,500
Bindura...	896.5	...	82	39	74.6	49.0	61.8	...	60.1	52.4	59	46	2.0	0.05	0.03	1	3,700
Bulawayo	874.3	873.9	81	40	71.5	47.2	59.3	60.8	58.0	49.0	54	40	3.1	0 03	0 03	1	4,393
Chipinga	897.7	...	76	44	68.9	50.0	59.4	...	59.4	53.3	70	49	3.2	1.02	0.54	8	3,685
Enkeldoorn...	862.1	...	82	39	70.0	45.3	57.7	59.9	57.0	49.8	61	44	3.0	0.04	0.04	1	4,788
Fort Victoria	901.0	900.7	81	37	72.3	44.2	58.2	58.6	57.0	51.1	67	46	2.0	0.13	0.07	1	3,571
Gwaai Siding	909.1	...	90	35	80.6	44.1	62.3	...	58.5	49.5	52	41	1.7	0.00	0.00	...	3,278
Gwanda...	911.8	...	85	39	75.4	48.5	61.9	...	61.2	50.9	50	41	2.6	...	0.07	...	3,233
Gwelo	866.9	...	80	37	70.5	45.1	57.8	59.6	57.0	49.7	61	44	2.7	0.00	0.08	..	4,629
Hartley...	890.2	...	83	35	75.5	44.7	60.1	62.3	58.6	50.9	58	44	2.0	0.07	0.02	1	3,879
Inyanga...	840.7	...	78	31	67.1	41.9	54.5	...	57.4	48.7	54	40	1.9	1.26	0.07	5	5,503
Marandellas	841.4	...	77	40	67.2	45.8	56.5	...	54.7	48.0	62	42	2.5	1.44	0 08	3	5,453
Miami	883.1	...	81	39	73.7	47.0	60.4	...	59.3	52.6	64	47	2.3	0.00	0.04	..	4,090
Mount Darwin ...	912.6	...	84	37	76.4	47.6	62.0	..	62.5	55.8	66	51	3.3	0.15	0 01	1	3,179
Mount Nuza	804.7	...	63	35	54.1	42.0	48.1	...	47.6	43.2	74	38	5.3	3.14	...	10	6,668
Mtoko	881.9	...	81	43	71.7	50.0	60.9	...	59.8	53.1	64	48	2.4	0.01	0.05	1	4,141
New Year's Gift. .	...	...	83	43	75.0	49.6	62.3	...	58.3	53.3	72	49	...	0.22	0.13	4	2,690
Nuanetsi	969.3	...	89	37	79.4	47.3	63.4	...	64.7	56.1	61	50	2.5	0.00	0 06	...	1,581
Plumtree	868.8	...	81	42	71.9	50.0	61.0	...	60.2	48.8	44	38	0.6	0.00	0.06	...	4,549
Que Que	886.7	...	84	39	74.8	47.7	61.2	...	59.3	51.0	57	44	2.6	0.00	0 01	...	3,999
Rusape	866.7	...	78	35	69.0	43.0	56.0	...	55.3	49.6	68	45	2.8	0.98	0.05	3	4,648
Salisbury	860.4	860.3	82	37	72.3	45.1	58.7	59.6	59.0	50.3	55	43	2.2	0.47	0.12	3	4,831
Shabani...	915.9	...	84	40	74.3	48.4	61.4	...	61.6	53.3	59	47	2.9	0.14	0.00	2	3,131
Sinoia	893.1	...	84	34	77.0	42.9	59.9	...	59.2	51.9	61	46	1.7	0.35	0.04	1	3,795
Sipolilo	889.8	...	81	39	73.3	48.8	61.0	...	62.5	53.6	56	47	2.0	0.00	0.04	...	3,876
Stapleford	846.4	...	70	28	61.0	39.3	50.1	...	52.2	48.9	80	46	4.2	3.61	0.64	10	5,304
Umtali...	898.2	897.6	81	39	72.4	48.0	60.2	61.4	58.5	54.1	76	51	3.7	0.99	0.19	6	3,672
Victoria Falls... ...	...	...	...	...	...	...	...	...	...	...	...	...	..	0.00	0.00	...	3,009
Wankie	932.1	...	93	46	85.2	58.0	71.6	...	66.2	53.8	43	43	1.2	0.00	0.01	..	2,567

Farming Calendar.

OCTOBER.

BEE-KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolic cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when the soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. If rains intervene, the carrying properties will be affected and the fruit will probably break down in transit. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

CROPS.

If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month. If seed potatoes will not keep in good condition until next month, they may be planted now, but later planting is better. Edible canna may be planted this month before rain falls. Also velvet beans, dolichos beans and sunn hemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted. On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize; therefore, do everything possible by cross ploughing, disc and drag harrowing to bring the soil into good condition for seeding.

When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs. Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

DAIRYING.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stocks require to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98° F. to 100° F.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones soon after they appear. The fruit of early peach trees should be thinned out if a heavy crop has set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough in December to outgrow serious damage. Maize beetle is now in its pupal stage. Thorough working and smashing up of the soil at this time will destroy great numbers.

Tobacco.—See notes for last month, together with article in the "Rhodesia Agricultural Journal" for October, 1926, on "Baiting of Tobacco Seed Beds with Cyanogas Calcium Cyanide." The lands must be kept free from all weeds which caterpillars may feed on, and it is well not to have maize, tomato and Cape gooseberries near the lands; a clearing of some depth is advisable, which must be regularly weeded. If poisoned bait is put down, it has been found that a covering of sacking or leaves will help to retain moisture and thus give further attraction, especially at this time

of the year. In order to lessen the heavy infestation of caterpillars and other insect pests in the seed beds, coverings of hessian or cheese cloth should be kept over beds, especially at night; cutworm moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night. Notwithstanding precautions in the covering of the beds, insects will enter, and after the emergence of the seedlings a weekly spraying should be carried out. Lead arsenate at the rate of 1½ ozs. (powder) or 3 ozs. (paste) in a 4-gallon petrol tin can be sprayed on the plants once a week to keep insect pests in check. Lead arsenate can be safely used with Bordeaux mixture, the constituents not reacting upon one another. The two combined sprays act as a preventative and deterrent to insect and fungoid troubles.

Cotton.—Thorough cultivation and keeping down of weeds should be resorted to in order to lessen the infestation of over-wintering pupæ, by exposure to the sun, and birds.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder), 1 lb. to 30 gallons of water; or (paste), 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb.; fresh water-slaked lime, 20 lbs. For cabbage aphis, water liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphis (green fly) is troublesome, the plants may be sprayed with soap wash or tobacco wash. Leaf-eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started, the damage is negligible.

Citrus.—All out-of-season fruit should be removed by this time. Destroy all fruit "struck" by the false codling moth. Aphis may be controlled by very careful spraying with the combined "Lime-Sulphur-Nicotine" spray (for details see "Rhodesia Agricultural Journal," September, 1926, page 871), while the yellow thrip may also be kept in check by this spray. Avoid using miscible oils for citrus spraying. A careful search should be made for the American bollworm (*Heliothis obsoleta*).

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste), 1 lb. to 10 gallons of water, or (powder), 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation.

Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FORESTRY.

The main sowings of Eucalypt (gum) seed should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilth in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn.

POULTRY.

October is usually a hot month, and poultry keepers should therefore see that their birds have access to shade during the day. At the same time they should have plenty of air. One often sees birds during hot weather sitting under dense bushes, which is almost worse than no shade at all.

All houses should be examined and, if necessary, repaired. It is advisable to repeat the caution that birds must have dry quarters.

Many poultry keepers do not realise the vital necessity of giving their birds, especially the young stock, plenty of succulent green food during the hot weather. It should be cut up and placed in boxes or hoppers about 7.30 a.m. and 5 p.m., and, if very hot, also at noon; it should never be placed in the sun. As much as the birds will eat should be supplied. Lack of it, especially during hot weather, causes a reduced output of eggs, smaller eggs and light-coloured yolks; further, a disease known as "nutritional disease," is likely to affect the birds and cause deaths. The symptoms are much like those of eye roup, without the well-known offensive smell of roup. It is due to the fact that vitamine A, which is present in large amounts in all succulent green foods, and which is so necessary for nutrition, is lacking. There is no doubt that many chickens and fowls die each year from this cause.

Ducks.—These during the hot weather require even more shade than do fowls; they cannot stand the direct rays of the sun nor sultry heat. The houses should always have dry floors, and should be overhauled before the rains commence. Ducks sleeping on damp floors often contract rheumatism and carmp. The floor of the duck house should be raised a few inches, thus ensuring a dry bed.

As many ducklings should be hatched as possible now, provided, of course, there is the prospect of a sale for them at ten weeks old. They thrive best in the wet weather.

Turkeys.—Stop hatching until after the wet season is over. To rear turkeys in the wet weather entails a good deal of time, labour, expense and often losses. Once a young turkey chick gets wet, it will probably die; at any rate, it will never be the same bird it would have been had it not got wet. Give the older turkeys all the range possible; the further afield they go, the better grown birds they become, and less is the expense of feeding. See also that their roosting quarters are water-tight before the rains commence.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded if this has not already been done, and care should be taken that they do not suffer any serious setback by reason of want of feed. The question of a mineral mixture should receive consideration.

Sheep.—If spring lambs are expected, one should see that the sheep-shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the event of late rains. All drinking places should be cleansed out, and care taken that the water supply is sufficient. Ewes for winter lambing should be well looked after, so as to get them up in condition before they are put to the ram next month. General shearing may start, including the April-May lambs.

TOBACCO.

Continue to sow seed beds. Where grass has been put on the seed beds to assist germination of seed a daily inspection should be made, and as soon as the first few plants make their appearance the grass should be raised up a little from the bed in order to prevent the plants growing "spindley." All possible preparation for the coming planting season should be made.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot, dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

The normal rainfall varies from three-quarters of an inch to an inch in the different portions of the country. The rain usually occurs in the form of thunder-showers, which are not long sustained and are fairly local, but the total rainfall experienced during the month does not vary much over the whole country, with the exception of the eastern border, where the rainfall is usually heavier.

NOVEMBER.

BEE-KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally. where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required. artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

CROPS.

Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check-row planting of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans and cotton will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour. use the disc harrow or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are liable to suffer later from stalk borer. At Salisbury, crops planted after 27th November have escaped serious injury, but early December plantings are probably the safest. Volunteer maize is commonly badly infested and should be cut out and removed immediately, otherwise the borers tend to spread to surrounding plants. If rain has fallen sufficiently early, lands may be baited at the end of the month against surface beetles, snout beetles and other pests which tend to reduce the primary stand of plants. The formula is arsenic of soda 1 lb., cheapest sugar 8 lbs., or molasses 1 gallon, water 10 gallons. Dip chopped Napier fodder or other green stuff and distribute broadcast. The poison may be sprayed over volunteer maize and weeds on land with good effect. Cutworms do not usually appear in numbers until December, except in low-lying lands. Succulent green stuff soaked in a 2 per cent. solution of sodium fluoride is the most recent formula for poisoned bait, but destruction of these pests is difficult. Keep the land clear of weeds as a preventive measure. If the young plants are attacked by the black maize beetle (heteronychus), the only remedy is to destroy by hand. Good, clean farming will control these pests to a large extent.

Tobacco.—This crop is subject to many pests in its early stages, although attacked by a few after vigorous growth has started. Keep cheese cloth covers on seed beds at night to exclude pests, and spray regularly with arsenate of lead (powder) 1 lb. in 30 gallons of water to protect against leaf-eating insects, etc. Lands may be baited against surface beetles with maize bran moistened with arsenate of soda 1 lb. in 30 gallons of water. Distribute in balls about the size of a golf ball and cover with branches or anything to protect from sun. Place one ball to each ten plants and moisten again when dry.

Potato.—The first brood of leaf-eating ladybirds appear in November. Spray with arsenate of lead (powder) 1lb. in 30 gallons of water. Spraying is also useful against the black blister beetles, which sometimes attack the crop on sandy soils. Keep the soil of irrigated crops well hilled and in friable condition as a precaution against tuber moth laying eggs on the tubers.

Kitchen Garden.—Plants of the cabbage family are liable to attack by diamond-back moth and other leaf-eating insects. When considered desirable, young plants may be dusted lightly with arsenate of lead (powder). Cabbage aphis may be kept in check by liberal watering and frequent washing with a forceful stream of water from a hose pipe or spray pump. Drenching the plants regularly with cold water is also held to be a good remedy for the diamond-back moth mentioned above.

Deciduous Fruits.—Young trees may need spraying with arsenate of lead (powder) 1 lb. in 20 gallons of water as a protection against chafer beetles, whose attack may check the growth very seriously. Choice varieties of early peaches may be netted to protect them from fruit-piercing moths.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to be excellently in this Colony:—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox. Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkins, mealies, peas and potatoes.

FORESTRY.

Sowings of eucalypt (gum) seed should be made for late planting. If fresh seed of cedrela toona is available, sowings should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used. Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

POULTRY.

Some birds will now be commencing to moult. This will cause a decrease in the number of eggs laid. The poultry keeper, therefore, should see that his birds come through the moult, as quickly as possible. Some birds will lay and moult simultaneously, but these are the strongest, most vigorous and the best layers; the majority do not. The process of moulting is a natural one, but it is a severe strain on the system. Fowls that are not too fat, and can stand extra feed at the commencement of the moult. come through it best. More green and animal food should be given, and the utmost care taken that they are not exposed to cold or wet, otherwise they will not only take longer to moult, but go off in condition. A little linseed stewed, or linseed meal, or ground nut meal and milk should also be given. There will next month be a demand for table birds, and such as the poultry keeper intends to sell should be selected. In making this selection, it is no use choosing old or scraggy birds, for it is hopeless to attempt to fatten these, or make them good table birds. Do not coop them up till a fortnight or so before they are to be sold give them free range and feed them well, with at least one feed of soft food mixed with milk once a day. Turkeys destined for the Christmas market should have free range, but also a feed of soft food once a day, and a good feed of mealies in the evening.

STOCK.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily. The grazing should be improving rapidly in feeding value. If normal rains have fallen. the grass should be sufficient for cows of average production. Heavier milkers should be fed concentrates at the rate of about 3 lbs. per gallon of milk produced over the first. In most cases maize meal alone will be sufficient for the purpose.

Sheep.—Dip sheep; put the rams to the ewes; keep the sheep on high dry land; be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

DAIRYING.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however, on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 to 50 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boilinig water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

TOBACCO.

Continue to sow seed beds, watering. etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out. Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity. Cultivate fields as soon as plants are established, to keep down weeds.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery. gradually gathering to burst in thunderstorms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy downpours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows. In a normal season the rainfall varies from two-and-a-half to three inches in Matabeleland, and from three-and-a-half to four inches in Mashonaland generally, with the exception of the eastern border, where it amounts to five inches. Between the rain periods and prior to the commencement of the rains, severe heat is likely to be experienced.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Insurance of Imported Stock.—A matter of the greatest importance to farmers in this Colony who import pedigree stock has just been settled. It concerns the rebate of 50 per cent. of the railage of such animals which is allowed by the railways when a satisfactory certificate is provided. It is the usual custom, and a very sound one too, for farmers to insure such stock from the time it is purchased until it arrives on the farm, and possibly for the next twelve months. Such insurance can cover all risks on the railways, and provided this insurance is taken out with the ordinary companies there is no difficulty in claiming the rebate. Several farmers have recently, however, taken out separate insurance to cover the

railway risks with the railway administration, and it has now been pointed out that under these circumstances the rebate is not allowed. The reason for this is that if the stock is insured with the administration it is, of course, conveyed at railway risk, and one of the conditions governing the pedigree stock rebate is that the animals must be conveyed at the owner's risk. It is obvious therefore that it is of the utmost importance to importers of pedigree stock that all animals should be privately insured and consigned at the owner's risk.

Sheep Blow-Flies: Request for Information.—The sheep-raising industry in the Eastern districts of the Colony, particularly Melsetter, is faced with many problems, not the least of which is that of controlling the activities of blow-flies. These flies lay their eggs in soiled wool around the tail end of sheep, or infest wounds, or injuries caused by ticks and other means. One of the commonest of these blow-flies is *Chrysomyia chloropyga*, Wied., a blue metallic species with the two end-segments of the abdomen coloured a bright brassy-green. The Department is anxious to obtain more information concerning this species.

Will farmers in the Eastern districts please send specimens of the maggots taken from the wool of Merino and other breeds of sheep? The maggots should be placed, alive, in a small container filled to the brim with dry soil, and sent to the Chief Entomologist, Agricultural Laboratories, P.O. Box 387, Salisbury.

Proposed Seed Wheat Association.—A draft constitution for the proposed Southern Rhodesia Seed Wheat Association has been prepared by the Agricultural Branch for the consideration of wheat growers. A general meeting will be held at the time of the next wheat show in December to form this Association. Copies of the draft constitution can be obtained from the Secretary, Wheat Growers' Association, P.O. Felixburg, or from the Agriculturist, Department of Agriculture, Salisbury.

The main objects of the Association are:—

(*a*) To provide for the supply to farmers and others of certified sound and reliable seed wheat under the guarantee of the Association in respect to purity, trueness to variety, breed character and germinating capacity.

(*b*) To assist members to dispose of their seed wheat.

(*c*) To promote the more general use by farmers in Southern Rhodesia of certified seed wheat.

(*d*) To provide members with information as to the best methods of production of seed wheat and to advance the interests of seed wheat growers by such other means as may be deemed expedient.

Export of Frozen Porkers and Baconers.—In August a small experimental shipment of 53 frozen porkers and 12 frozen baconers was sent to Smithfield. The reports so far received are very satisfactory, and the prices obtained are higher than those paid for any of the three previous consignments. The porkers realised from $5\frac{1}{2}$d. to $6\frac{1}{4}$d. per lb. and the baconers 76 shillings per cwt. When full details are received a report giving all particulars will be published in this *Journal*.

Feeding Cattle for Export.—The following notes by Mr. H. A. Wootton, the Government Inspector of meat for export should be considered by all farmers feeding cattle for the overseas market. They were included in a report on the chilled beef shipped on the "Windsor Castle" on October 9th.

"This week's shipment will not be quite up to the standard of that of last week, but the percentage of Imperial grade beef is fairly good, considering that this is a poor season of the year for cattle. Even so, I should like to see a better finish on the beasts by means of a somewhat longer feeding period. If farmers are going to feed at all it seems a pity to only go half way with the process. In many cases two or three weeks extra feeding would have made all the difference between a poorish Standard grade quarter and an Imperial quarter. I suggest that this point of view should be strongly impressed on those interested in the feeding of beef for the chilled meat trade.

Both the Standard and the Imperial grades for this week were of very nominal standard, but I would call the entire shipment a good medium run of beef, with nothing much outstanding except a few well finished quarters.

I am glad to say that the age of the cattle during the past few weeks has been appreciably younger, and I feel certain that this fact will be welcomed in London and will help tremendously in satisfactory marketing there and in improving the good name of Rhodesian beef."

Referendum on Egg Marketing Bill.—The Government Statistician's report on the referendum taken in September-October has now been published. In view of the fact that so many of the poultry farmers did not reply, and of the replies received there was such a small majority in favour of the Bill, the Government has decided not to proceed with the matter any further.

Out of the 1,137 voting papers despatched, only 500, that is 45.3 per cent., were returned duly completed. Six hundred and thirty-seven voters failed to reply. It would therefore appear that the majority of the poultry owners were indifferent to the issue or were unable to decide one way or the other.

Out of the 500 voting papers completed and returned to the Government Statistician, 31 were invalid through being spoilt papers, leaving a balance of 469 valid voting papers.

The tabulation of the answers to the questions on the 469 valid papers gave the following results:—

For the Bill	249
Against the Bill	220

It would appear therefore that the salient results of the referendum are as follows:—

(1) A majority of poultry keepers, *viz.*, 54.7 per cent., have *not* returned their voting papers.

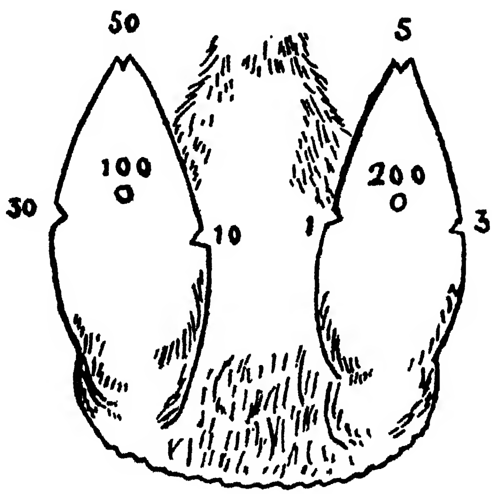
(2) Of the 469 voting papers returned and found to be valid, 249 poultry keepers, or 53.1 per cent., are in

favour of the introduction of the suggested Egg Marketing Bill.

(3) The majority of the poultry keepers owning 50 to 99 birds each are *opposed* to the suggested Bill.

(4) The majority of the poultry keepers owning 100 or more birds each are in *favour* of the suggested Bill.

Marking Pigs.—It has been suggested that the system of marking pigs as illustrated in the last *Journal* is not sufficiently clear, and that as this is of great importance in keeping satisfactory records, the description, there given should be more fully explained.



The illustration shows the manner in which young pigs may be ear marked with a clipper so that any number between 1 and 500 can be indicated with ease. It will be noticed that if two notches or two holes in the same position indicate double the value illustrated the system is self explanatory; and that the two notches need only occur on the insides of the ears, and are only used when indicating 2, 7, 20 and 70.

Notes on The Water Law of Southern Rhodesia.

Contributed by MR. JUSTICE MCILWAINE, K.C.

The first European settlers in South Africa brought with them the Roman Dutch law from Holland. That law, in so far as it related to water, being designed for a humid country, was not suitable to the arid conditions of South Africa where water is a very valuable asset. This led to frequent and often costly litigation between rival claimants to the use of water. From time to time there has been legislation to remedy the position. This culminated in the Union Irrigation Act of 1912. That Act introduces certain new principles and makes provision for the control, apportionment and use of water; but as, no doubt, the vested rights of users rendered any radical change in the substantive law governing water rights difficult, the Act is based on the common law as evolved and expounded by the Courts.

On the occupation of what is now the Colony of Southern Rhodesia the common law of the Cape Colony, then introduced, applied to rights to water. In the earlier years of settlement there was not a great deal of competition for the use of water and consequently little litigation. This may also have been partly due to the form of land title commonly issued which, in the case of farms bounded by rivers, fixed the inner bank of the stream as the boundary and so avoided controversy as to the respective rights of riparian owners. Further, in what is known as the Gold Belt, it was usual to restrict the use of water by landowners. The laws passed from time to time governing the acquisition of mining rights made provision regarding the use of water by mines. Act 9 of 1910 laid down the conditions on which railways could acquire water for their purposes.

In 1911 a Bill designed to deal with rights to water in a comprehensive way was introduced in the Legislative Council. In the course of its discussion emphasis was laid on the desire to make provision which would avoid the constant litigation which had taken place elsewhere in South Africa.

Notwithstanding that, it embodied some of the outstanding features of the Union law. Eventually the Bill was withdrawn in order that the members of the Council and the people might have more time to consider the important principles involved. Thereafter the Government went very carefully into the whole question and as a result of an exhaustive study of the laws of other countries it was decided that the best course was to make a complete departure from South African precedents and, save as to existing rights, to vest all public water in the State and prescribe the conditions on which it should be apportioned to users. A draft Bill embodying these principles was prepared and received the wholehearted approval of the Agricultural Union, the representative of the farmers, except that they contended that the benefits contemplated would be largely nullified unless the law regarding miners' rights to water were repealed. The Bill, as drafted, was introduced into the Legislative Council in 1913. In its passage through the Council, although the principle of State ownership of public water was adopted, for reasons which it is now difficult to appreciate, a number of amendments were introduced preserving the old doctrine of riparian rights and other common law features which largely destroyed the underlying principles of the measure. The result was the "Water Ordinance, 1913." Notwithstanding this unfortunate result the advocates of reform did not abate their efforts, and a further Bill was introduced in 1920 with the object of restoring the principal features which had been previously rejected. It was then possible to point to the deficiencies of the 1913 Act, as experienced in its administration, and the amending Bill received the approval of a sympathetic House. On the passing of the 1920 Act the law operated with general satisfaction, but the farmers still felt that the rights possessed by miners under special laws were an unnecessary obstacle to meeting the reasonable requirements of landowners. After protracted negotiations between the interested parties a large measure of agreement was secured. It was the aim of the Government to amend the law generally in the light of the experience now available and to bring the rights, not only of farmers and miners, but also urban authorities requiring water within the compass of one general law. This was accomplished by a consolidating and

amending Act in 1927, which repealed and amended the Water Ordinances of 1913 and 1920. This Act also provided the terms on which rights to public water could be acquired by miners, railways and local authorities.

The following notes on the "Water Act, 1927" are intended to give a general indication of its provisions for the information of farmers, miners and others who may be interested. Those desiring to study the details of the law are referred to the Act itself. The waters of the Zambesi and Limpopo rivers, in so far as they constitute boundaries of the Colony, are governed by International Law and are consequently excluded from the provisions of the Act.

PRELIMINARY.

(Sections 1 to 5).

The preliminary portion of the Act contains definitions, and, after stating that the sole and exclusive use of private water belongs to the owner of the land on which it is found, lays down the fundamental principle that all other water is vested in the Governor and that its use, diversion and apportionment must be made in accordance with the provisions of the Act and the regulations made thereunder.

A study of the definitions shows that the amount of water which can be regarded as private is very limited and that rights to all other water, generally called public water, are governed by the Act and regulations. As a good deal of confusion as to the position exists, it may be well to quote the following definitions in full:—

> "Private Water."—All water, not being water of a public stream, which rises naturally on any land or which falls or naturally drains on to any land, so long as it remains on such land and does not join a public stream.

> "Public Stream."—A watercourse of natural origin wherein water flows in ordinary seasons, whether or not such watercourse is dry during any period of the year and whether or not its conformation has been changed by artificial means.

"Public Water."—All water flowing or found in or above the bed of a public stream, whether visible or not, including swamps or marshes forming the source of such a stream or found upon its course.

The intention of these definitions was not so much to limit the rights of individuals as to make provision which could be used in safeguarding the general interests of the country. For instance, it may seem an unnecessary restriction to prohibit a farmer making whatever use he pleases of water found in swamps and marshes on his land, but as these places must be regarded as the sources of supply of water for the common good it is important that their value should not be impaired by an individual searching for water. Unfortunately great damage is also constantly being done to these sources of supply by operations unconnected with obtaining water. Section 108 (1) (*b*) does authorise the Governor, with the approval of Parliament, to take steps for the protection of the source of supply of a public stream. No action has so far been taken under this Section. It is feared that it would be difficult of application in the many cases where protection is greatly needed. It seems most desirable that the Water Court or other authority should, without delay, be empowered to curb the operations of those who, often ignorantly, are dissipating the natural assets of the country.

CHAPTER I.

Use of Water for Various Purposes.
(Sections 6 to 23).

Any person has the unrestricted right to take water for domestic and drinking purposes and for watering stock from public waters in their natural channels or beds, whenever he has lawful access thereto. For example, a person travelling on a public road with his stock is entitled to take water for his and their use from a stream where it crosses the road because he has access to it without trespassing. In the same way a landowner can take water for the same purposes, known as primary use, from public water to which he is riparian, but if he desires the water for secondary use, that is for the irrigation of his land, or for tertiary use, that is mechanical or industrial purposes or the generation of power, he must

be authorised under the law. Where water is not being used by riparian owners its use may be given for land which is not riparian. Tenants and occupiers of land may, with the consent of the owners, get rights to water. Anybody may be authorised to use water for tertiary purposes if the primary or secondary use by riparian owners is not affected thereby. Cases may arise where the water of a public stream can be used to so great an advantage for tertiary purposes that secondary rights should be subordinate thereto. It is therefore provided by Section 12 of the Act that in such cases the Governor may, on the recommendation of a Water Court and subject to the approval of Parliament, authorise any person to use public water for any undertaking of such public importance or general utility that the advantages thereof would, in his opinion, outweigh the disadvantages. Existing right holders would be entitled to compensation for any prejudice suffered by such a grant.

Certain rights are conferred on miners by the mining law in respect of water for domestic purposes, subterranean and flood water, but anyone desiring to use public water for mining purposes must apply through the Mining Commissioner for the authority of the Water Court. Water already in use for secondary purposes may be given to the miner, but the secondary user is entitled to compensation which, if not mutually agreed upon, is fixed by the Water Court.

Authority to use public water for railway purposes must also be obtained from the Water Court, and any prior legal user of water whose rights are impaired is entitled to compensation in the same way as when water is granted to miners.

Similar provision exists where water is desired by local authorities, such as municipalities, town and village management boards, except in cases where the supply of water is obtained under special legislative authority.

All applicants for the use of public water are required to apply to the Water Registrar and furnish the information called for in the prescribed forms, and also supply such further particulars as the Registrar may deem necessary.

Water rights granted in respect of land are recorded by the Registrar of Deeds, and pass with the land on transfer.

In the same way rights in respect of mining claims pass with them on transfer but lapse on the abandonment or forfeiture of the claims.

It sometimes happens that a Water Court grants rights to water in respect of an area of land held by one owner which is afterwards subdivided among a number. The result might well be that the use of water intended for the whole farm would be confined to one subdivision. To meet cases of this nature the law provides for a revision of grants on subdivision of land so as to secure an equitable apportionment of water to the various owners.

CHAPTER II.

WATER COURTS.

(Sections 24 to 58).

The law provides for the appointment of one or more Water Courts by the Governor for hearing and deciding upon all applications for the use of water, disputes in connection with the use, diversion and appropriation of water and also for dealing with numerous other matters provided for by the Act.

The Court is composed of a Water Court Judge and two assessors. The Judge must be an advocate or a magistrate, and such magistrate is required to be of at least ten years standing. One assessor must be a Government Irrigation Engineer, and the other, known as the unofficial member, is ordinarily selected according to regulation from a list of assessors nominated by the Governor. This list consists of landholders and other persons in responsible positions, who are on the voters' roll of the Legislative Assembly and are not in the public service.

If the Court has to deal with some matter requiring a special knowledge, not ordinarily possessed by a person on the list of assessors, the Governor may nominate a special assessor.

When dealing with applications for the use of water for mining purposes a Mining Commissioner acts as assessor instead of an unofficial member. In cases of urgency a Mining

Commissioner may issue a provisional order authorising the use of water for mining purposes, subject to subsequent confirmation or modification of such order by the Water Court.

When no Court is sitting the Water Court Judge is empowered to grant provisional rights on unopposed applications for the use of water. He may also, on good cause being shown, extend the time within which grantees are required to complete their works and he may also grant interdicts in matters within the Court's jurisdiction.

A Water Court may accede to or refuse any applications for the use of water or may accede to it subject to such terms and conditions as it may deem fit to impose. This does not mean that the Court can deal with applications in an arbitrary manner or attach unreasonable conditions to the rights granted by it. The Water Court must not only give careful consideration to matters coming before it and exercise a judicial discretion in dealing with them but also must observe certain principles laid down by the Act. It is provided, for example, that where there is more than one application for the same water, everything else being equal, the first applicant is to receive preference. When water is desired for irrigation purposes, the Court is required to consider the extent and nature of all land irrigable by that water, especially riparian land. The proposed method, or possible methods, of user and also the economic aspect of the scheme must be examined. For example, the Court would not favourably regard a proposal to use water on unproductive land where it could be used to better advantage on good land, nor would it encourage an applicant to undertake a scheme which, owing to expense, poorness of soil or any other reason, appears to be economically unsound.

It is assumed that when a person applies for the right to use water he intends using it, therefore at first the Court grants a provisional right which fixes a reasonable time within which the necessary works for using the water must be completed and no final right is given until completion has been certified by a duly appointed engineer. It is the Court's practice to give ample time for the construction of works and,

for good cause, to extend the time originally fixed, but if it is clear that the applicant has no serious intention of proceeding with the undertaking the provisional right lapses.

The Court endeavours, as far as possible, not to grant rights to the use of water from a stream beyond what can be satisfied by the volume flowing therein, but, in case a scarcity should arise from abnormal drought or other cause it is provided that on that happening the rights must be satisfied in the order of their priority. This is governed by the dates of lodging the original applications. In order that a right holder may not be required to abate his use in case of shortage, unless such user should actually contribute to such shortage, a Water Court may lay down local limits beyond which rights of priority may not obtain.

It often happens that when an application is made for the use of water landowners and others lodge objections on the grounds that the granting of the rights desired would affect their primary rights to domestic supplies of water required for their live stock. Such objections are quite superfluous, inasmuch as the law provides that no grants made by the Water Court can interfere with these primary rights.

Any surplus of water used for mechanical, industrial, power or mining purposes must be returned to the public stream at the nearest convenient point in an unpolluted condition.

Persons acquiring rights to water for mechanical, industrial or power purposes sometimes require to enter on another person's land for the exercise of such rights. The law provides that, failing agreement between the parties as to the terms on which the necessary land may be expropriated, the Water Court may fix the compensation to be paid.

If rights to water are used unreasonably, or not in accordance with the authority granting them or if the works are not maintained in a state of efficiency, the Water Court may cancel or revise the terms of such rights.

The procedure in a Water Court is in accordance with its own rules, or failing such rules those of Magistrates' Courts

as far as applicable. The Court avoids formality and expense and endeavours to dispose of matters in the simplest and most expeditious manner possible.

Before proceeding to deal with any matter submitted to it the Court must be satisfied that all persons having an interest therein have been notified. If they raise any objections or desire to make any representations they are informed of the date and the place of the Court's meeting in order that they may pursue the same. It is the practice of the Court, except in minor unopposed matters, to inspect the site of the proposed undertaking, take evidence on the spot, when any reports of experts are put in. Thereafter the Court having arrived at its decision in the light of its inspection and the evidence and reports received has it communicated to the parties concerned.

Applicants or objectors in Water Court proceedings appear in person or by an advocate or attorney. Costs in Water Courts are based on the scale of charges in Magistrates' Courts.

An appeal lies from decisions of the Water Court to the High Court and the Water Court may state questions of law arising before it for the opinion of the High Court.

CHAPTER III.

Combined Irrigation Schemes, Irrigation Boards and Loans.

(Sections 59 to 85).

It sometimes happens that, owing to the heavy expense involved or some other reason, landowners are debarred from undertaking irrigation projects individually, but are prepared to join together in a general scheme of irrigation for their common benefit. The law provides for such persons petitioning the Minister for authority to carry out a combined irrigation scheme. If the Minister is satisfied that the petitioners own not less than one-tenth of the land proposed to be irrigated he refers the petition to a committee for investigation. If thereon it appears that the owners of not less than two-thirds of the irrigable area consent to or do not oppose the scheme, he refers it to the Water Court for consideration and decision. The Court, after taking into consideration all material

matters, may approve of or disallow the scheme. If it approves it allocates the quantity of water to be used, fixes the irrigable area on each farm and the maximum expenditure to be incurred, etc. The Court may, from time to time, authorise the enlargement, restriction or other alteration of a combined scheme, and the Governor may, on the Court's recommendation, cancel or revise rights under such scheme in case of failure or neglect to use them.

An owner for whose lands water from a combined scheme is available, except exempted for good cause, is liable to repay a portion of the expenditure incurred on the scheme, although he may not desire to participate therein.

If the participants in a combined scheme exceed three in number they are required to elect an Irrigation Board for the purposes of such schemes. The election is by persons whose names appear on the irrigation voters' list. The number of votes of such persons is in proportion to their holding of land in the irrigable area.

Irrigation Boards levy rates on land scheduled as irrigable within its jurisdiction and may for this purpose frame an irrigation assessment roll. It may also raise loans. The procedure to be observed by Boards in carrying out their various functions is prescribed by the Act or regulations framed thereunder.

Loans may be made by the Government from funds voted for the purpose for irrigation works. Such loans may be repaid by instalments spread over a period not exceeding thirty years and of sufficient amount to redeem the loan and cover interest charges, which may not exceed £8 per centum per annum. These loans attach to the land as mortgages and pass with it on transfer.

CHAPTER IV.

SERVITUDES.

(Sections 86 to 102).

It frequently happens that a person who has been granted the right to use water from a public stream is unable to exercise that right without entering upon or using the land

of another. If it is necessary to store the water on another's land he must get a servitude of storage; if the water has to be passed along the land of another a servitude of passage is required. When it is desired to divert water from a public stream by a dam or a weir abutting on another's land a servitude of abutement must be obtained.

The parties concerned may agree between themselves as to the terms on which a servitude may be granted. Failing this the person claiming a servitude is required to serve the owner of the land over which it is desired with a written notice setting out particulars of what is required. If the passage or storage of water is asked for the line of passage or place of storage and the site of all proposed works must be stated; also the time for which the servitude is desired, the quantity of material required from the other's land and the compensation offered for the servitude. If the person from whom the servitude is claimed does not agree thereto the claimant may apply to the Water Court for its decision in the matter.

As it is undesirable that anyone should be allowed to encroach on the land of another except for very good reason, the law has laid down a number of conditions which the Water Court must observe in order that servitudes may not be lightly granted.

The owner of land over which a servitude exists may make use of the irrigation works incidental thereto for the passage, storage or diversion of water to which he may be entitled, on terms agreed upon with the holder of the servitude or failing agreement on conditions fixed by the Water Court.

The right of servitude includes the right to enter upon the land affected to do anything that is necessary for the enjoyment of the servitude, but it is also subject to the obligation to exercise the same in a manner calculated to cause the least possible loss or inconvenience to the other party.

In order that a servitude may be binding upon other than the original parties thereto it must be registered in the Deeds Office against the title of the land affected.

Rights to servitude lapse if the works necessary thereto are not constructed within three years from the granting

thereof or such extended period as the Water Court may fix; they also lapse through the failure or neglect of the holder to use them for a continuous period of two years.

CHAPTER V.

General.

(Sections 103 to 106).

When a public stream, which forms the boundary between landowners, changes its course, the boundaries are not thereby altered. If on such a change a landowner wishes access to the stream he may apply to the Water Court for authority, or if injuriously affected by such change he may be authorised by the Court to construct works necessary to restore the stream to its original course.

The 1927 Act preserves all rights to water acquired prior to the passing thereof. These chiefly consist of rights granted under the earlier statutes. The holders of rights acquired under the Common Law in the early years of settlement were entitled to have their rights determined and recorded but, on the whole, they preferred to apply for and obtain definite grants under the statute law.

Provision is made for the appointment of a representative of native interests on Irrigation and River Boards, also on Water Courts where the interests of natives in Native Reserves may be effected. Further, combined schemes or awards by a Water Court which may substantially affect such interests may not be given effect to until specially approved by the High Commissioner, unless, in the case of a decision or award by the Water Court, where the Governor certifies that native interests will not be substantially affected thereby.

CHAPTER VI.

Powers of the Governor.

(Sections 107 to 112).

This chapter authorises the Governor to appoint officers necessary for the carrying out of the Act and empowers him to establish hydrographic stations, procure statistics, carry out, supervise and maintain irrigation works and advise

owners. He may further, with the approval of Parliament, construct or acquire irrigation works, supervise public streams, regulate the diversion, storage and distribution of public water and appoint River Boards.

This chapter also provides for entry upon the property of others by persons carrying out duties under the Act; it also prescribes the necessary procedure to be observed in the service of notices, orders and other documents and authorises the Governor to make regulations for the purposes of the Act.

CHAPTER VII.

Offences and Penalties.

(Sections 113 to 117).

Having adopted the principle of State ownership of public water, it is important that adequate provision should be made for its supervision and preservation; consequently it has been provided that any person is guilty of offence and liable to suitable punishment if without lawful right or authority (the proof whereof lies upon him) he

(1) alters, enlarges or obstructs an irrigation work, or destroys, defaces or removes any level mark, beacon or other structure or appliance erected or made in connection with such work;

(2) impounds, diverts or takes, for other than primary use, any public water, unless authorised in terms of this Act or in the exercise of a legal right existing at the time of the coming into operation of this Act;

(3) interferes with or alters the flow of or pollutes or fouls the water of an irrigation work or of a public stream, or interferes with the distribution of such water, or, after notice to refrain from doing so, takes more water than he is entitled to, or uses it in a manner contrary to this Act or the regulations;

(4) while using or being liable for the maintenance of an irrigation work, to the prejudice of others wastes or does not take due precaution to prevent the waste of water from such work, or fails properly to maintain the work and keep it in repair;

(5) wastes the water of a public stream;

(6) being the proprietor of an area, after notice from the Minister or other official authorised by him, fails to put an end to waste of water resulting from the act of a tenant or other person deriving rights from such proprietor and no longer present on such area;

(7) aids or abets or knowingly permits any such act or default.

Often, especially in remote parts of the country, use is made of public water for irrigation and other purposes without any authority. It is rarely, hitherto, that this has been treated as a criminal offence, but it is a foolish procedure not only because it is contrary to the law but also because such user can confer no rights to the water. It is sometimes urged that the cost of obtaining the Water Court's sanction in such cases is a deterrent to applicants. This cost is very moderate. Section 45 of the Act empowers the Governor, with a view to fostering the use of water for irrigation and other purposes, to authorise the charging of costs on a reduced scale. In exercise of this power it has been laid down that an applicant for water for irrigation purposes may not be charged more than five shillings costs in respect of each acre which he may be authorised to irrigate.

Notes from the Cotton Station, Gatooma, 1936.

By A. H. McKinstry, Empire Cotton Growing Corporation.

Although a number of articles on cotton have been written in this Journal, it is felt that a few further notes will be opportune before the start of another crop-planting season. The results of the past season both at Gatooma and for the country as a whole will be dealt with first. Secondly, as insect pests are very important factors in reducing crop yields, a short account will be given of the habits of the more important ones and the most practicable methods of minimising the damage caused by them. And finally the important facts in connection with seed, spacing, thinning and farming practices will be summarised.

THE 1935-36 SEASON.

At Gatooma the latest planting rains on record, over a period of twelve years, coupled with the drought of over two weeks immediately after the start of planting, gave the worst conditions possible for the start of a season. With the exception of a few acres of cotton which were sown on December 14th the main acreage was planted from 19th to 24th of December. Seed of most of these latter plantings did not germinate until after January 10th. Rains after this date were adequate and well distributed.

As there was no choice, the sowing of all crops had to be concentrated into a short period; and on this account little could be done to arrange for other crops which attract the American bollwom egg-laying moth to be in flower during the first month of the flowering of the cotton crop. In addition, it may be noted that although the quantity of American bollworm moth egg-laying was only of a moderate order, yet this season, compared with others, seemed to be particularly favourable for a high larval survival rate from this egg-

laying. The effects of Sudan bollworm attack which are usually noticeable about March-April, were more apparent this year under conditions under which the crop could only be produced late. Jassid attack was severe on two bulk acreages, and this contributed to depress yields. The sum total of these adverse factors was to reduce the crop yield on bulk acreages at Gatooma to the low mean of about 300 lb. seed cotton per acre.

On farms and from plots of cotton grown in the native reserves, yields, with few exceptions, may be considered satisfactory under the conditions of the season. In not a few instances yields of 500-600 lb. of seed cotton per acre have been picked, and some of them have exceeded the 800 lb. mark.

It would seem that many growers planted their cotton early, relative to other crops, and made every effort by good farming practices to give the crop a chance to arrive, in normal time, at its flowering stage. In some areas the fact that cotton was planted dry and the plants got away earlier than many fields of maize which, owing to scanty rainfall had to be replanted, undoubtedly helped towards heavier yields. Thus during the first weeks of flowering of the cotton crop a larger acreage of maize than is usually obtained would have been at its tasselling stage and therefore attractive to American bollworm egg-laying moths. In this way maize shared w th cotton the egg laying of the pest.

It may be stated that there is no objection to dry planting of cotton seed, provided that the seed is sound, that it is planted at a heavy seed rate, and that the land is well prepared to receive it. As with maize or any other crop the risk has to be taken that the planting rains are sufficient both to germinate the seed and to start healthy growth. The farmer may take the gamble; but no blame should be attached to the cotton crop if the gamble fails.

INSECTS.

Jassid.—In the foregoing it has been mentioned that jassid attack and its damage were severe on plants of the strains growing on two bulk acreages on the Station this season. One of these bulks was planted nearby to a plot of

cotton left as standover, for purposes of experiment, from the previous season. Jassid was bred up on the standover crop and when the plants were uprooted about the middle of February, the jassid population migrated to the young cotton plants which were the most attractive on the Station at that time. In the other bulk where damage by this insect was pronounced the plants were growing on soil which is definitely below average in fertility.

It can be emphatically stated that the Gatooma strains now in commercial cultivation possess a good degree of jassid resistance, and that only under very unfavourable conditions will they show the effects of jassid attack. There are, however, strains of U.4, as well as other varieties, which have a greater degree of jassid resistance than those which are at present in commercial cultivation. These latter are, however, earlier fruiting and yield more heavily. Both selection and cross fertilising with strains is being carried out in order to build up a greater degree of jassid resistance in strains. Seed issued from Gatooma from time to time is specially bred for a greater degree of jassid resistance in conjunction with other desirable characters.

American Bollworm.—The moth lays her eggs singly on any part of the plants to which she may be attracted. She is active at night, chiefly it is thought, about dusk. The larvæ (caterpillars) which hatch from the eggs damage the crop by burrowing into buds, flowers and bolls of the plant. When first hatched the young larvæ feed chiefly on young buds and flowers; later, as they grow bigger, they are more nomadic in feeding and they attack the older bolls. Usually bolls which are older than three weeks old escape attack, except in seasons when the larval population is large in proportion to its food supply.

If the moths are on the wing they are attracted into cotton to lay their eggs when the plants are in flower—usually during February. Egg laying also takes place on other crops such as varieties of maize, millets, beans and tobacco when these are in flower. Records over a number of seasons on plant development in conjunction with insect incidence indicate that no appreciable egg laying on cotton takes place

until the greater portion of the commercial maize plantings has finished taselling. Furthermore, if there are acreages of later maize for ensilage or beans or tobacco in flower nearby the cotton fields when these are also in flower, the moth population will spread its egg laying over a range of crops and will not concentrate on the cotton alone. By comparison with the damage to cotton, that done to other crops is negligible.

From what has been written on the habits of the insect it will be realised that damage to the cotton crop by the insect may be largely minimised by giving the plants every chance to set an early crop of bolls; that is:—

(*a*) By sowing sound seed of the newer U.4 strains as soon as practicable after planting rains set in. The seed may even be dry-planted in certain instances.

(*b*) By cultivating to keep down weeds; and by thinning the plants to proper spacing in good time. In short, by promoting healthy growth of the crop so that it arrives at its flowering phase in normal time from the date of planting.

(*c*) By arranging a programme at planting so that areas of crops other than cotton are at their optimum flowering periods during the first month or six weeks of the flowering the cotton. In this connection the following data may be of some use.

Crop.	Approximate number of days from planting to beginning of flowering.	Approximate period soon after beginning of flowering during which crop is most attractive to American bollworm egg-laying moth.
Cotton	65-70 days.	4-6 weeks.
Dolichos Beans ...	52-57 days.	4-6 weeks.
Maize (Hickory King)	55-60 days.	2 weeks.
Kaffir Corn...	66-70 days.	2 weeks.
Amber Cane	53-58 days.	2 weeks.

Sudan Bollworm.—The habits of this insect are like those of the American bollworm in that the moth lays her eggs singly on any part of the plant; and she is active at night. Also, the larvæ feed on the buds, flowers and bolls of the plant. The pest, however, differs from the American bollworm in the following:—

(1) The older Sudan larvæ are not as nomadic in feeding; they destroy more completely the bolls which they attack.

(2) The cotton plants need not be in flower for the Sudan moth to be attracted to lay eggs.

(3) With the exception of cotton there are no known alternative food plants in the cotton growing districts on which Sudan feeds and breeds. The moths are probably capable of flight over long distances and by such means primary populations become established in cotton growing areas.

(4) The pest in its larval stage is most abundant on cotton during a March-April period by which time, in the majority of seasons, the crop is set.

About April-May when the larvæ have become fully grown on cotton they pupate (become chrysalises) and in this state they over-winter in soil cells. The first moths emerge from the over-wintering pupæ about the last two weeks of September and the peak of emergence occurs about the time of the first rains. Moths which hatch out during September and October lay their eggs on any standover cotton of the previous season's crop and in this way a generation of the pest can be bred up on the standover crop. But this generation may be destroyed if the lands are cleared of cotton plants not later than the last week of October. If cotton plants, either in the form of a ratooned or standover crop, are allowed to remain on the lands they form suitable areas for the pest to breed up and eventually to be carried over in larger numbers to the young plants of the annual crop. Egg laying then takes place on the young plants and the larvæ from these eggs destroy the young buds.

The pest, however, does carry itself over to the annual cotton through a proportion of the moths which emerge from over-wintering pupæ about the time of the first rains, but in

this instance the moth population is very much smaller than it would be if it had been increased by moths bred up on standover plants.

Ratooned or standover crops should therefore never be allowed.

Cotton Stainers.—The adults of these insects lay eggs in nests which may be found under fallen leaves, etc., in the field. The eggs hatch not into larvæ but to wingless forms of the adult; these wingless forms are known as nymphs. After a period during which the nymph sheds its skin several times the winged adult emerges. Both nymphs and adults feed by sucking the juices of cotton bolls. In doing so they may inject bacteria which set up rots (internal boll diseases) and cause discolouration of the lint: similarly the viability of the seed may be destroyed. Seed required for planting should be taken from the first picking of the crop, which should be reaped as soon as there is sufficient seed cotton open on the plants to allow of a picking of about 50 lb. seed cotton per boy per day. As the insects start to migrate into cotton from their alternative veld food plants, about the middle to the end of February, it will be appreciated that the earlier the plant sets its crop of bolls the less likely are these to be damaged by stainer attack.

In the above notes on the American bollworm and cotton stainers it has been stressed repeatedly that the setting of an early crop of bolls is of paramount importance to crop yield. No better method is known whereby the damage caused by these insects can be minimised. Of equal importance, in connection with the Sudan bollworm pest, is the advice that ratooning of cotton should not be practised.

GENERAL NOTES.

This section of these notes is not written so much as advice to those who have experience in the art of cotton growing as a guide to growers who will be planting the crop for the first time.

(1) If practicable, plan the planting programme so that other crops which are attractive to American bollworm egg-laying moths are in flower during the first month to six weeks of the flowering of the cotton crop.

(2) Sow healthy seed of the newer U.4 strains. This seed may be obtained through the Ginnery at Bindura. If machine planted about 25-30 lb. seed. per acre will be required "Shoes"(1) may be affixed to the seed shoots of the planter to prevent the seed being drilled too deeply. If hand planting is adopted with rows 3 feet 6 inches apart and a spacing of 9 inches to 1 foot between plants in the row, and six seeds to the hill, the seeding rate would be about 15-20 lbs. per acre. Whether the seed is planted by hand or by machine it should only just be covered by the soil.

(3) Plant the seed on well prepared land of average fertility as soon as possible after the planting rains have "set in." If so inclined dry plant the seed, but keep a reserve for replanting should the rains be unfavourable.

(4) If thinning is unduly delayed competition amongst plants checks normal development. Thin the crop when the plants are about 4 inches high. The rows are normally 3 feet to 3 feet 6 inches apart, and on most types of soil plants may be thinned to 6 inches apart in the row; or if preferred two plants to the hill with 1 foot between the pairs. On rich land a spacing between plants in the row of 15 to 18 inches may be adopted with advantage.

(5) It is very important that the crop in its early stages of growth should not be checked by weeds. It can be left to the discretion of growers to decide on the number of machine and hand cultivations which may be necessary to keep the lands free of weeds. After the crop has started to flower freely, cultivations should be shallow. Deep cultivations at this stage would damage the lateral roots and so cause shedding of young bolls, etc.

(6) When there is a sufficient number of bolls open on the plant to allow a picker to pick 40-50 lbs. (or more) seed cotton per day, a first picking may be harvested. Badly stained seed

cotton should not be taken in the first picking; it should be left for a later clean-up. Broken leaf and trash mixed with the seed cotton considerably lowers its value.

(7) Sound seed stock is as equally important as viability or germinating capacity of the seed. It is therefore to the grower's interest to make sure that woolpacks are adequately labelled with the strain number of the seed when sending seed cotton to the Ginnery at Bindura.

REFERENCE.

(1)G. S. Cameron, *Rhodesia Agricultural Journal.* Vol. XXVIII., No. 10, October, 1931, page 903.

Witchweed.

By S. D. Timson, M.C., Assistant Agriculturist.

Witchweed is still a very serious menace to the maize-growing industry, so serious in fact that there are a number of farmers who are to-day bankrupt or threatened with bankruptcy owing to the losses it has caused them, through neglect to control it in the past.

Apart from the cost of measures of control of the parasite, which appear to vary from sixpence to six shillings per acre, the direct loss to the maize growers each year, owing to the reduction in the yields of their maize, has been estimated as being between £100,000 and £200,000 per annum. The writer is convinced that it is considerably above the lower figure. If an average figure of 3s. per acre be taken as the cost of witchweed control, on the 210,000 acres under maize in the maize belt this will give a total of about £30,000. The total loss caused to the farmers of this Colony by witchweed would therefore be from £130,000 to £230,000 annually.

That this loss can be almost entirely wiped out by the use of the proper methods of control as advocated by this Department cannot be doubted, since there are many farmers who are to-day proving it, and some of these farmers were almost despairing of combating the pest five or six years ago.

Evidence that the above statement is correct is arriving daily in the replies to a circular enquiry sent to a number of farmers, who are known to be successfully combating the pest. It is hoped to be able to publish these replies at a later date.

The following notes on the practical control of witchweed are largely based on the observations made by the writer during the past season, which has been particularly favourable to the growth of this parasite. Those readers who are studying this problem for the first time are reminded that other articles on the subject have previously been published in the following issues of this journal:—

November, 1929.—Reprinted as Bulletin No. 759.
March, 1930 (p. 295).
January, 1931.—Reprinted as Bulletin No. 802.
December, 1931.—Reprinted as Bulletin No. 838.
January, 1933.
December, 1933.
March, 1934 (p. 169).
November, 1934.—Reprinted as Bulletin No. 936.
November, 1935.—Reprinted as Bulletin No. 972.

It is sincerely hoped that those farmers, who at present only have a mild infestation of witchweed on their cultivated lands, will nevertheless treat the matter with all the seriousness it deserves. No problem the grower of maize has to face is of such importance to him as that of controlling witchweed, for if he neglects it he will be facing bankruptcy in a few years time, unless he can find a cash crop to replace maize, and the best brains in the country have so far failed to do this. It is not going too far to say that at all times the control of witchweed must have precedence over all other work on the farm.

The Seasonal Factor in Witchweed Control.—The past two seasons have been an almost complete contrast. In 1934-35 the first half of the season was extremely wet, and the rains almost continuous up to the last week in January, after which very little rain fell.

Such a season is very unfavourable to the growth of witchweed and therefore to the success of trap-cropping for the reasons given by the writer in an article on witchweed published in the November, 1935, issue of the *Rhodesia Agricultural Journal.* In that article the writer warned farmers that the results from traps sown during the 1934-35 season would be disappointing, and such has been the case in many instances. The results, however, would not have been so disappointing had the 1934-35 season been followed by a more or less normal season, but, unfortunately, the past (1935-36) season was particularly favourable to the growth of witchweed for the following reasons. The first half of the season was exceptionally dry with only light rains in between long periods of bright hot weather. For this reason soil temperatures were high and favoured the germination of witch-

weed; and the soil was dry and friable, and was not packed by heavy rains, and this favoured the emergence of the witchweed seedlings through the soil. Probably the most favourable seasonal effect on the germination of witchweed was owing to the fact that root development of the maize was stimulated greatly by the dry conditions, and also that the activating substance excreted from the roots which germinates the seeds was not diluted so much by the light rains as to be ineffective, as happened undoubtedly in the preceding season. Since the conditions were so favourable to the germination of witchweed they naturally favoured the efficiency of trap-cropping, and the writer, for that reason, is prepared to prophecy that the results from trap-crops planted during 1935-36 will be exceptionally good, provided, of course, that such traps had a sufficient rainfall to make good growth.

Since all methods of control of witchweed are primarily dependent on the germination of the seed of the parasite it is clear that their efficiency must be largely dependent on climatic conditions. The effectiveness of hand cultivation, for instance, is likewise dependent in the first place on the seasonal factor, for the parasites cannot be destroyed effectively until they appear above ground.

The writer has discussed this point at some length because it is of the greatest importance that the farmer, who is fighting witchweed, should be able fairly to judge the results of any methods of control he may be employing, and without a knowledge of the great effect that the seasonal factor may exert he may draw entirely erroneous conclusions from what he observes, and so be led to condemn valuable methods of control. That this has frequently happened the writer is only too well aware.

Storm Drains.—Every experienced farmer admits the primary necessity of efficient storm drains round his fields to protect the latter from re-infestation from the veld, but the writer's personal observations have shown that many farmers are neglecting these drains, which are in many cases no longer effective in carrying off heavy storms.

All storm drains should receive careful annual inspection before the commencement of the rains to ensure their being in good order.

CONTROL BY CULTIVATION.

Hand Cultivation.—Hand cultivation, when properly done, is an effective method of control for light infestations, but it is expensive. To reduce the expenditure on hand cultivation it should be combined with trap-cropping and machine cultivation.

This question of the reduction of the necessary hand cultivation to the minimum is of increasing urgency owing to scarcity of labour which is being experienced in most parts of the maize belt to-day.

Those farmers *who are failing to control the parasite by hand labour*, whether it be on account of shortage of cash or shortage of labour, should for the time being replace their sunnhemp or other green-manure with one or more trap crops of amber cane or white Kaffir corn or, better still, native Sudan grass. Continuing with green-manuring will only increase their difficulties, since this practice causes a great increase in the amount of witchweed appearing above ground in the following maize crop. Trap-cropping, on the other hand, will reduce the amount of hand-labour required to destroy witchweed.

That this leads to little if any loss in yield of the following maize crop (providing the trap crop makes good growth) is indicated by the results of a series of experiments carried out at the Salisbury Experiment Station discussed later in this article.

Deep versus Shallow Hoeing.—There is still considerable difference of opinion between farmers as to whether shallow hoeing of witchweed or deep hoeing is best. The writer has always advocated shallow surface hoeing, and evidence that this is much cheaper is supplied by the costs on two farms in the Mazoe Valley where these two methods are employed. On farm A the parasite is lightly hoed each time it *commences* to flower and is left on the land. On farm B the parasite is hoed as deeply as possible, and the parasite is collected and removed from the land. On farm A the cost of the work from mid-February to mid-May has been slightly less than 1s. per acre (11.8 pence), and on farm B the cost for the same period was 40.82 pence per acre, or over three times as great. The

costs in both cases are worked out on the same basis of 9s. 10d. per boy's "ticket," and 56 "boss boy days" at 1s. 4d. per day.

The writer can also state from his own personal observation that on farm A there was very much more witchweed than on farm B, since farm A is being reclaimed from many years of neglect by the previous owner, and on farm B the witchweed has been very effectively controlled for some 6 or 7 years.

These costs of witchweed control are of great interest, since their accuracy can be vouched for, and other farmers are advised to check their own costs against them as a test of the efficiency of their own hand-hoeing.

The costs of control on the farm of probably the most successful grower of maize in the Mazoe Valley have been received since the above was written. His method is that used on farm A, namely, surface hoeing and leaving the parasites on the land. On the same basis of average wage of labour and native supervision his cost per acre was 11.7d. per acre for the past growing season. The severity of the infestation of his fields is probably intermediate between that of farms A and B.

Machine Cultivation to Save Hand Labour.—As has been repeatedly urged by the writer in previous articles, machine cultivation should be employed as far as possible to economise hand labour. Check-row planting of as large an acreage of maize as possible should be done, and then single oxen, mules or donkeys can be used with a suitable type of cultivator with duck-foot or other cutting points, for cultivation between the rows of maize, leaving only the few witchweed plants near the stems of the maize for removal by hand.

Check row attachments for existing maize planters can be obtained for about £6, are easily worked by natives, and will plant over ten acres a day. A number are doing excellent work in the Colony.

An article describing how to make a single-ox yoke appeared in the March, 1930, issue of this journal.

Another way in which the common farm equipment can be employed to reduce hand cultivation is by spacing the maize sufficiently widely to permit the use of a section of a

spring-tooth harrow drawn by two oxen for cultivation throughout the growing season. This system was employed by Mr. G. P. Ingram on his farm last year with success. Experiments carried out on the Agricultural Experiment Station at Salisbury proved that a spacing of 6 feet by 9 inches gave over a period of three years the same yield of maize as the normal spacing of 3 feet by 18 inches (*R.A.J.*, June, 1933).

Hand-picking on Contract.—It has been brought to the notice of the writer that some farmers are in the habit of giving their labour task work at the rate of so many bags of witchweed per day, presumably with the idea of saving themselves the trouble of supervision. Such a practice is criminal folly, for the natives naturally only weed those portions of a field where witchweed is growing thickly, and if it is not thick enough there they have been known to go into a neighbour's fields where it is thick enough for their liking. It is hardly credible that any farmer could be guilty of such crass self-deception, but my informants are men of standing. It savours of the habits of the frightened ostrich.

Pumpkins in the Maize Crop.—The practice of sowing pumpkins under maize on land infested with witchweed must be whole-heartedly condemned since it renders the hand-cultivation of the parasite much more difficult and costly, and at the same time a proportion of the weeds remain hidden under the pumpkin leaves to seed down. Under such conditions too it is obvious that that effective supervision of the work is impossible.

Late Weeds on Infested Fields.—For the same reasons as specified above it is very bad practice to allow a heavy crop of late weeds to grow after the last machine cultivation on infested maize lands. They seriously interfere with the supervision and hand-cultivation of the witchweed.

Trap-cropping.—This method of control remains, and is likely to remain, the best and cheapest method by far of controlling witchweed on all types of soil, where the infestation is a general one, and where it has an easily observable ill-effect on the maize crop. Where a farmer cannot easily control the pest by machine and hand cultivation he should not hesitate to replace his green-manure crop by a trap-crop.

The regular use of a trap instead of the green-manure will at once greatly reduce the cost of hand cultivation, unless the soil is so severely infested that two or three traps are necessary.

In this connection the following extracts from a letter from one of the best farmers in the maize belt may be quoted. This gentleman in 1933-34 ploughed under a green-manure crop on one 70 acre field (No. 2), and on another field of 70 acres (No. 1) he ploughed under one trap-crop of amber cane. Since then he has reaped two maize crops and controlled witchweed by hand cultivation. In a letter dated 18th of July he states:—

"*Field No.* 1 *has cost* £1 *per year in labour on witchweed and is practically free from it.* (The writer can personally vouch for the latter statement.)

"*Field No. 2 has cost £12 per year in labour on witchweed and is still badly infested.*

"*On the two years the yield from both fields has been practically identical.*"

He further states: "*I am, in view of my experience, firmly convinced that trap-cropping is the only effective way and also the least expensive, of eradicating witchweed.*"

"*It has proved so successful over the past three years that I intend to use it in my crop rotation until I have been over the whole of my lands.*"

This gentleman broadcasts the amber cane seed at about 25 lbs. per acre on the maize stubble after disc-harrowing, and covers the seed with a drag harrow. After ploughing under the amber cane he immediately broadcasts Kaffir beans thickly, and these in turn are ploughed under to supplement the green-manuring effect of the trap crop. Should the ploughing under of the trap be unduly delayed by wet weather the Kaffir beans then help to remedy the nitrogen robbery which may result. [See article on witchweed published November, 1935, in this journal.] If required, the Kaffir beans can be harvested for hay, of course.

Sunnhemp followed by Trap Crop.—If the farmer wishes to delay sowing the trap so that ploughing under may be done in March or if he wishes to get a useful return from the land, it is excellent practice to sow sunnhemp at double green-manuring rates before the rains on the maize stubble, and cut it for hay after it has made 6 weeks to 2 months growth. The trap-crop may then be broadcast on the stubble of the sunnhemp and covered by a spring-tooth harrow or a light discing. Sunnhemp is proving itself to be a very valuable and palatable hay crop all over the Colony, and the hay crop reaped in this way should pay for the cost of the trap crop.

If the above system is adopted it will be advisable to fertilise the soil to ensure a good growth of the trap crop.

A Legume Hay Crop after one Trap Crop.—The sowing of a legume for hay after ploughing under an early-sown trap crop can be strongly recommended, and several farmers are regularly doing this.

Sunnhemp makes very palatable hay when cut as it commences to flower, and the hay is of a high feeding value and probably superior to cowpea hay in this respect. It has been fed with excellent results over the past three years to fattening cattle, working oxen, and dairy cows by a number of farmers. To obtain fine stems it should be sown at at least double the normal rate of seeding used for green-manuring. Cowpeas or Kaffir beans can also be employed in the same way, and one farmer now makes this his regular practice.

In addition to the value of the hay crop, the soil fertility is considerably raised by the legume stubble, and should there be danger of nitrogen robbery of the soil through enforced delay in ploughing under the trap crop owing to wet weather, this practice will tend to correct this.

The Green-manure Value of Single Trap Crops.—The green-manure value of two trap crops ploughed under in one season, within two months from their germination, has been clearly established by experiments carried out by this Department, and reported in an article by the writer, which was published in the November, 1934, issue of this journal.

A further experiment was laid down in that year to test the value of a single trap crop ploughed under as a green-manure compared with sunnhemp. The sunnhemp was sown on 4th December, 1934, and the trap crops on the 20th December, 1934, in order that all the crops would be at approximately the optimum stage of growth for ploughing under at the same time. It was found, however, that one of the two strains of sunnhemp was somewhat immature at this time, and this probably partly explains the low yields following this crop compared with those following the trap crops. In 1934-35 no fertiliser was applied, but in 1935-36 all plots received a dressing of 20% superphosphate at the rate of 200 lbs. per acre.

SERIES 5.

Plots 1/16 acre. Design:—Two randomised blocks of six treatments.

Treatment during 1934-35. Crops ploughed under 20.2.35.	Average yields per acre of maize bags of 200 lbs., 1935-36.
Sunnhemp (2 strains)	20.34*
Amber Cane	21.40
White Kaffir Corn	21.88
Wintersome	21.44
Maize (reaped for grain)...	15.60

*This figure is the average of 4 plot yield; each of two strains of sunnhemp having been sown on two plots. One of these strains was somewhat immature when ploughed under.

The replication of blocks in this experiment was insufficient to yield a significant result in one season, but the above figures at least indicate strongly that one trap crop of amber cane or Kaffir corn, when ploughed under within two months from germination, is not very inferior to one crop of sunnhemp as green-manures in their effect on the yield of a following maize crop. It is obvious, of course, that a single trap crop sown on soil severely infested with witchweed would not make strong enough growth to give the same green-manure effect as when grown on witchweed-free soil, but the application of phosphatic fertiliser would greatly assist the growth of the crop, and would be recovered in the succeeding maize

crop. Farmers who are having difficulty in controlling witchweed can therefore be urged to replace the green-manure crop in the rotation with at least one trap crop. They will thereby suffer little if any loss in the succeeding maize crop, and will reduce the infestation of their soil by witchweed rapidly and cheaply, and at the same time reduce the cost of hand labour. It is already the regular practice of some of the most successful farmers.

Wintersome was included in this experiment because at that time it was thought that it might possibly prove useful as a trap-crop, but further experience over the past two years leads the writer to believe that this crop will not be an efficient trap crop on account of its slow growth during the first two months, and because it is not a good host of witchweed compared with our best trap crops.

Fertilising the Trap Crop on Exhausted Soil.—Unless a trap crop can thrive it cannot do its work of germinating witchweed properly, and therefore if the soil is in poor "heart" it may be necessary to apply fertiliser before sowing the trap. On some of the badly eroded soils of the maize belt it is almost useless to sow a trap crop, without first building up the fertility of the soil. Under such conditions a sunnhemp crop might be sown thickly with phosphatic fertiliser before the rains and ploughed under at six weeks growth, then left to rot for two or three weeks, and followed by the trap crop sown at 50% more than normal rate of seeding, to allow for poor germination.

In extreme cases of erosion even this system will not be practicable and it may be necessary to supply potash as well as phosphates to the sunnhemp crop and allow this to make full growth, postponing the sowing of the trap till the following year. Since all traps are grass-type crops, it must be borne in mind that unless nitrogen is supplied by a previous legume ploughed under it will be necessary to supply the trap crop with this plant food in the fertiliser, on badly exhausted soils.

Alternatively one or more legume hay crops such as sunnhemp or Somerset velvet beans, may be grown with potash

and phosphatic fertilisers before sowing a trap to build up fertility. This system will have the merit of providing the farmer with some return for his expenditure.

Types of Trap Crop Recommended.—Nothing has occurred to necessitate the revision of the recommendations made in the past with regard to the suitability and efficiency of Sudan grass (ordinary annual type), Amber cane, and white Kaffir corn as trap crops, but, as will be mentioned later, it is now considered that native Sudan grass will prove to be superior to all three, and that munga may be usefully employed as a partial trap-crop under certain conditions.

Certain well-known and influential farmers are condemning amber cane as a trap crop, because they state it is not a good host of witchweed, and they are doing any of their fellow-farmers who believe them, a serious dis-service in doing so. *Amber cane, providing it is a pure strain and has not been crossed with an inferior sorghum host, is one of the four best trap crops and is as efficient in germinating witchweed as any of the other three, as judged by experience in the field.*

That this is so is being demonstrated by a number of farmers every year, who are regularly employing it as a trap crop. The reader may also be referred to the remarks of one of the best farmers in this Colony quoted above under "Trap Cropping," who has been using it for three years now with great success. There are minor objections to amber cane as a trap, such as the fact that it is not easily killed by ploughing and that it, like Kaffir corn and ordinary Sudan grass, does not thrive under heavy rainfall, but of the three traps commonly used in the Colony, taking all points into consideration, it is the best trap crop of which seed is at present commercially obtainable.

Rhodesian Sudan Grass.—Native or Perennial Sudan Grass (*Sorghum arundinaceum*). To distinguish this indigenous grass from the ordinary Sudan grass which is an annual, it is proposed in future to refer to this grass as Rhodesian Sudan grass. With the valuable co-operation of more than twenty-five farmers this grass has been under trial for the past four years now and the writer is satisfied that it is a very valuable addition to our trap crops, and he is of opinion that it will, for the following reasons, prove to be our best.

Trap Crops.—Rhodesian Sudan grass on left. Amber Cane on right. Ten weeks old. Note no flower heads on latter, and only a few on Sudan grass. As traps should be ploughed in within eight weeks from germination.

Amber Cane on left. Wintersome on right. Ten weeks old. Latter very slow growing at first and not a good trap crop.

Munga.—Grown as a trap crop between wide-spaced maize on Mr. G. P. Ingram's farm. A practice not recommended for the lazy farmer owing to need of close supervision of witchweed brought up by maize.

Giant Witchweed (*Striga hermonthica*). Note the tall unbranched stems. The flowers are pink, not scarlet. Reports of its occurrence are required.

Its free-seeding, perennial habit, hardiness, and vigorous growth under both wet and dry climatic conditions first directed the attention of the writer to the possibilities of this grass some six years ago, and also the fact that it is an indigenous grass, which thrives throughout the Mazoe Valley. At that time it was not known whether Rhodesian Sudan was a host of witch weed or not, but trials over three years indicate that it is at least as efficient a host for the germination of witchweed as our present best traps such as ordinary Sudan grass and amber cane. In addition it offers these advantages as a trap crop:—

(1) It will thrive under the wettest climatic conditions of the Mazoe Valley, and also under the dry conditions of Matabeleland.

(2) It is much more easily killed by ploughing under than amber cane and Kaffir corn, and has not the same tendency to make "re-growth" from uncovered roots. In support of this it may be cited that Rhodesian Sudan grass has never shown any tendency to become a nuisance as a weed on farms in the Mazoe Valley.

(3) It is a perennial and therefore a seed plot need not be sown each year.

(4) It has yielded approximately 20,000 lbs. per acre of green fodder for silage or hay in a comparative trial with amber cane and Kaffir corn, which yielded 14,000 lbs. and 16,000 lbs. respectively.

(5) It is a heavy seeder and one acre of the grass may be expected to yield sufficient seed to trap crop 16 to 24 acres.

(6) With regard to its possible poisonous properties, it appears to be much freer from this disability than amber cane and Kaffir corn, and to rank with ordinary Sudan grass in this respect.

Furthermore, it is the chief constituent of some of the best pastures in the Concession district, and is to be found on many farms in the Mazoe Valley.

A considerable body of evidence collected by the writer goes to indicate that it is seldom, if ever, very dangerous to

stock in the green state, though this cannot be definitely stated, and more evidence on this point is required and would be welcome.

In the form of hay or silage it is quite safe to feed to stock, and will prove to be a very valuable reserve feed for stock.

Seed of Rhodesian Sudan Grass available for Trial.—Farmers are advised to use this grass as a trap crop, and a limited quantity of seed is available from this Department for free issues to farmers for the purpose of laying down seed plots of two acres.

Applications for the seed will be filled strictly in rotation as they are received.

Munga (*Peunisetum spicatum*) **as a Partial Trap Crop.**—Munga or pearl millet is peculiar amongst the grass-type crops in that although it excretes the substance from its roots which stimulates the seed of witchweed to germinate, yet it is apparently immune to the parasite in that the latter is not able to reach maturity. Saunders states* ". . . this crop has never been observed to suffer any noticeable injury from *Striga lutea* at Potchefstroom, nor have full-grown parasites been found upon its roots."

This immunity of munga to the parasite may prove to be of some value to the farmer fighting witchweed, and it is suggested that its use in the following ways might be tested.

(1) When a farmer is afraid of sowing two traps in one season on sticky soil owing to the danger of his being unable to plough under the first trap owing to unfavourable conditions, he can sow munga (at the rate of 30 lbs. per acre broadcast) as the first trap. Should a prolonged wet spell then prevent the ploughing under of the munga at the proper time (6 to 8 weeks) there will then be no danger of the witchweed setting seed before he can carry out the ploughing.

It must be borne in mind, however, that most of the weed grasses found growing on farms in this Colony are more or less hosts of the parasite, and that if they grow up with the munga they will probably germinate a certain amount of

*Studies in Phanerogamic Parasitism, by A. R. Saunders.

witchweed; but they usually, in the writer's experience, bring it to the surface later than does the maize crop, or good trap crops such as amber cane and white Kaffir corn. There will obviously, however, be danger from this source where a poor stand of munga is obtained.

Another point to be remembered in using this crop as a partial trap crop is that it is not so effective in germinating witchweed as our best traps, and *will probably only germinate about half the quantity of seed germinated by such traps as amber cane or white Kaffir corn.*

On the other hand it appears to be a very much better "change crop" for maize to follow than the sorghum type traps mentioned above. This was clearly indicated in an experiment carried out on the farm of Mr. G. P. Ingram, as will be described later.

(2) One farmer in the Mazoe Valley broadcasts maize thickly as a trap crop and grazes if off with his working oxen before ploughing under the stubble. A thickly sown crop of munga should prove considerably more valuable for this purpose than maize, firstly because it does not bring witchweed to maturity, and secondly because it can be left in over the whole season and grazed several times, and thirdly because it is probably a much better change crop for maize than maize itself. The grave danger of packing or puddling the soil by grazing the crops when the soil is moist must be remembered.

The writer does not, however, favour this method of control, since he is of opinion that a trap crop of amber cane or white Kaffir corn ploughed under, and followed by a crop of sunnhemp for hay would be more valuable, both from the point of view of control of the parasite and from the stock feed point of view, since the sunnhemp hay can be saved for feed in winter when it is of much greater value than summer grazing.

(3) Where sunflowers are grown they might be sown at a spacing of 6 feet by 9 inches, and munga broadcast in between the rows at the last cultivation in January. The munga could be cut for hay or grazed off by cattle and sheep after reaping the sunflowers.

(4) If a farmer has use for an annual hay crop munga might be utilised for this purpose, and cut before flowering. If cut at this stage the stems are not too hard and pithy, and a second cut can be obtained.

Enough has been said to indicate ways in which munga can be usefully employed in the control of witchweed, but the writer considers it necessary to emphasise the fact that it is not a first-class trap crop for witchweed; *that it will only germinate about half the quantity of the parasite germinated by our best trap crops, and that, therefore, too much must not be expected of it as a trap crop.*

That munga is an excellent "change crop" for maize is indicated by an experiment carried out during the past two seasons through the kind co-operation of Mr. G. P. Ingram on his farm at Concession.

During the season 1934-35 munga, white Kaffir corn and Rhodesian Sudan grass were sown in parallel strips on very severely infested red loam soil on 21st December, 1934. This field was so severely infested that it had only yielded 1 bag per acre three years previously, when maize was last grown. During growth of the crops the witchweed was carefully removed by hand before setting seed. On the 25th March the Rhodesian Sudan grass and white Kaffir corn were deeply hoed under. The munga was allowed to mature and then burnt on the land. In 1935-36 maize was sown and the crop reaped with the following results:—

Treatment.	Yield in bags per acre.
After Munga	7.00
After White Kaffir Corn...	3.98
After Rhodesian Sudan ...	4.65

During the growing season there was a markedly much more vigorous, even and robust growth of the maize following munga than that after the other two crops. The maize following the latter crops was very patchy and uneven. There was slightly more witchweed visible on the plot following munga than on the other plots, but this was not marked.

It is considered that the small amount of witchweed that appeared in the munga plot during 1934-35 was germinated and brought to the surface by a certain amount of weed grass (chiefly Guinea Fowl or Kokoma grass) which had not been removed.

Although this experiment by the nature of its limited scope and design could not yield accurate results, it furnished strong evidence that munga exerts a very much better effect on a following maize crop than the other two crops when they are reaped at maturity.

Grassing Severely Infested Fields.—In co-operation with this Department several farmers during the past three years have been testing the value of Rhodes grass and Woolly Finger grass for pasture on soil which is severely infested with witchweed. The results are very satisfactory and it is now possible to recommend this practice where it fits in with the organisation of the farm. Both woolly finger grass and Rhodes grass have made excellent and normal growth on very severely infested soil, and only a very few weak plants of witchweed have appeared amongst these grasses. Generally speaking, there is a great shortage of good grazing on farms in the maize belt, and the above two grasses both yield pastures which are much superior to the average veld grazing, and Rhodes grass provides also a heavy hay crop of excellent quality.

If, therefore, owing to labour shortage or for other reasons, a farmer is having difficulty in controlling the witchweed, he can temporarily reduce the acreage under maize by laying his worst infested fields down for a few years to Rhodes grass, or if he wishes to put them under permanent pasture he can plant woolly finger grass as well. Rhodes grass is seeded down at the rate of 4 to 10 lbs. per acre according to the quality of the seed, which is obtainable at about 1s. 4d. to 1s. 6d. per lb. Woolly finger must be propagated from roots, which cost 7s. 6d. to 10s. per bag. Where virgin land is available this can be broken up to replace the infested fields which are grassed, and those farmers who are so fortunately situated are advised to do this without delay if it fits into

their general scheme of farming. If the fields to be grassed lie above other cultivated land, then the latter should be protected from re-infestation from the small amount of witchweed seeding down in the former by contour ridges or storm drains.

The results obtained in this Colony with Rhodes grass and woolly finger grass are completely confirmed by the results obtained by Saunders at Potchefstroom and published recently in *Farming in South Africa.* He has carried out tests on heavily infested soil of a number of the best pasture grasses, including twelve varieties of finger grass, Rhodes grass, and woolly finger grass. Of these grasses he states that except in the case of the Kuruman strain of finger grass none of these grasses from January, 1934, when they were first planted, up to February, 1935, brought any witchweed to the surface.

The possibility of laying down first-class pastures on heavily infested soil opens up an opportunity for the farmers of the maize belt to break away from the one-crop type of farming whereby they are yearly exporting the fertility of their soil, which is their capital. It makes possible the maintenance of a much larger number of stock, including sheep, on their farms, and thus changing to a more mixed system of farming, which is so desirable, and at the same time easing their difficulties in controlling witchweed.

In this connection I may mention that during 1935 some 16,000 head of sheep were imported into this country, which should have been produced in Southern Rhodesia, and there is no reason why they should not be produced in the maize belt.

Saturation Point.—It is not sufficiently realised that there is a natural limit to the extent to which cultivated soil may be infested by witchweed. That limit is reached where the parasite is allowed to seed down year after year until finally there are so many seeds of the parasite in the soil that neither the host crop nor the parasite can make enough growth to set seed. In other words, the host is killed by the numerous parasites on its roots before those parasites can reach the surface of the soil.

The writer has seen examples of this every year, though they are fortunately becoming rarer.

In such extreme cases some farmers are puzzled to find that although the maize is obviously killed by the effect of the parasite, yet no plants of witchweed are seen above ground. The writer wishes to advertise this matter, because it has in some cases in the past led to the erroneous condemnation of some of our best trap crops.

If on a field which is "saturated" in this way with witchweed seed one trap crop is ploughed under, then in the following season if maize is planted, far more witchweed will appear above ground than has ever been seen before. Why? The answer is that the single trap has germinated and killed sufficient of the witchweed seed to make it possible for the maize to grow strongly enough to supply nourishment to the witchweed and bring it above the level of the soil. Under such conditions at least three trap crops would have to be grown and ploughed under in order to reduce the amount of witchweed to such level that little of the parasite will appear above ground.

Such a severe degree of infestation is rarely if ever seen over a large acreage in this Colony, but is quite commonly met with in small and large patches in fields of maize. These patches are the result of allowing the witchweed to seed down every year for a number of years.

Patchy Infestations.—If such patches are present in a field, but are not sufficiently numerous or large as to reduce the yield of maize over the whole field below the economic level, they are best treated in the following way:—

When the witchweed first commences to flower hoe the patches over deeply, cutting out all the maize plants and the witchweed too. Return in 14 to 16 days and hoe out any witchweed that has made its appearance since.

In some cases it will be useful to sow these patches thickly with munga, which will germinate more witchweed, but will not bring it to the surface to mature seed. These patches of munga will form a useful addition to the grazing for the cattle when the maize has been reaped.

If the parasite has inadvertently been allowed to seed down on such patches, it is useful practice to pile grass over them and burn it. This will kill most of the seed lying on the surface.

Giant Witchweed (*Striga hermonthica*).—This much more robust variety of witchweed, which grows to a height of 2 to 2½ feet, has been found growing on maize on four farms near Hartley, and one at Umtali during the past two or three years. The flowers are the same shape as those of the common witch-weed, but are normally of a lightish pink in colour. The stems are normally unbranched, and the leaves few in number. It forms far fewer seed capsules and it is probable that it takes considerably longer to come to maturity than the common variety, and for these reasons will be more easily controlled than the latter. The same methods of control are equally applicable to both varieties.

Reports of its occurrence on other farms would be welcomed by this Department.

Notes on the Optimum Time for Ploughing under a Green Manure Crop of Sunnhemp.

By R. McChlery, B.A., B.Sc., Division of Chemistry.

The practice of ploughing under green manure crops is now widespread in this country, particularly in the large maize growing belts, and the resultant advantages are too well known to require further reiteration. At the same time the question is often asked "What is the best time to plough under a green crop?" The obvious reply is that this should be done when conditions are such that rapid decomposition will be ensured, namely, at flowering stage or soon after, and before the last rains. If the crop is in a succulent condition, the prevailing temperature high, and the soil reasonably moist, the plants will soon be broken down. If the crop is too mature, hard and fibrous, decay will be slow. Such practical generalisations are of great value and have formed the basis of the successful results obtained. The matter can, however, be considered in a more accurate manner, and much work has been done in Europe and America on the conditions for satisfactory decomposition of plant residues, and on the actual progress of the decomposition. The following note outlines some of that work, and proceeds to apply it to the case of green manure crops of sunnhemp grown on the Agricultural Experiment Station, Salisbury.

The decay and incorporation of green manure in the soil has been shown to be a very complex process dependent on the chemical composition of the plants as well as on soil and climatic conditions. The decomposition is brought about by a variety of micro-organisms living in the soil, and the chief products are carbon dioxide, nitrate and soil organic matter

or humus. It may be regarded as an oxidation, oxygen being absorbed and an approximately equal volume of carbon dioxide evolved. It has been shown, too, that no matter what the composition of the plant substances to be decomposed, whether green manure, straw, leaves or animal manure, the final humus has much the same composition and properties. The micro-organisms require a number of substances for their growth, including carbohydrates, nitrogen and phosphates, and it has been found that there is an intimate relation between the carbon and the nitrogen of the material to be decomposed.

From a study of the literature, it would appear that there is an optimum nitrogen content of the plant which is just sufficient to meet the requirements of the micro-organisms concerned in the decomposition. If the plant contains more than this nitrogen, the excess is rapidly liberated in an available form and may be lost from the soil through leaching. If the plant contains less, an additional source of nitrogen will be required before it can be completely decomposed. This the micro-organisms take up from the nitrates in the soil. The lower the nitrogen content of the plant the greater is the amount of additional nitrogen required, or the longer will be the time of the decomposition process. Waksman and Tenney(1) working in America found this nitrogen value to be 1.7 per cent. expressed on the basis of the dry matter of the plant. Lyon, Bizzell and Wilson(2), also in America, showed that nitrate is taken up from the soil during the decomposition of plant residues containing less than about 1.8 per cent. nitrogen; this amount seemed to keep the process self-supporting. Workers in Great Britain considered the subject from the relation between carbon and nitrogen. Thus Russell(3) states "if the ratio of carbon to nitrogen in the crop is more than 20, the organisms effecting the decomposition may require more nitrogen than is supplied by the crop. in which case they draw on the soil nitrates that would otherwise either be washed out or taken up by the plant. If, however, the ratio is less than 20, the organisms may not need

the whole of the nitrogen; they then leave the excess in the soil in the form of nitrate, which as before, is either washed out or taken up by the plant." Jensen(4) gives the ratio as one part nitrogen to 20-25 parts carbon when the soil is neutral, and 1 to 13-18 when it is acid. Only where there is excess of nitrogen above this amount does nitrate appear in the soil. Gilbert and Pember(5), and others have shown also that the incorporating in the soil of large quantities of poorly decayed organic matter of low nitrogen content has an inhibitory effect on subsequent plant growth.

Experimental: Season 1933-34.—Analyses were made on sunnhemp sampled at various stages of its growth and the results examined in the light of the above conclusions. The crop was planted on 15th November, 1933, and samples were taken each week from 24th January to 5th April, 1934. Sampling commenced just as the crop was coming into flower, and continued each week until flowering ceased and seed had set. The soil of the station is a red loam, typical of the soils of the maize growing areas, and is almost neutral in reaction (pH. 7.1). The rainfall for the season was almost 25 inches, 16 of which had fallen before the first sampling was taken. The rainfall each week during sampling is shown in the table with the analytical data. Determinations were made on the whole plant, including roots from which the soil was carefully washed, and on the plant above ground. Carbon, nitrogen, phosphoric oxide, and fibre were estimated and the results expressed on the basis of 100 per cent. dry matter. There did not appear great differences between the results from the whole plant with roots, and from the plant above ground, so the figures given in the following table are for the whole plant with roots, and may be regarded as representative of the composition of the material to be decomposed when sunnhemp is ploughed under as a green manure.

Analyses of Sunnhemp.—A study of Table I. shows that the nitrogen, potash and phosphoric oxide values dropped until the middle of February, three months from time of planting,

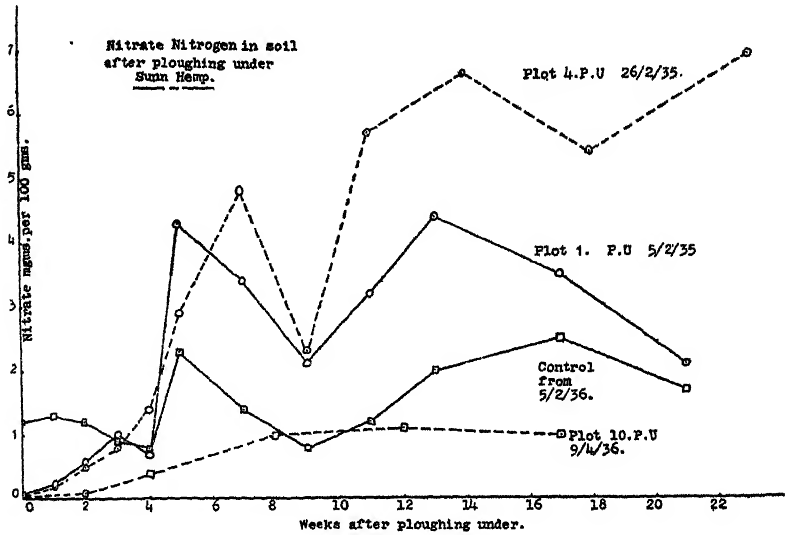
and when the crop was in full flower. The fibre values rose and the carbon-nitrogen ratio widened during the same period. At this stage the nitrogen content of the crop was 1.9 per cent. and the carbon-nitrogen ratio 22.4. These values approximate to the figures given in the works quoted as being adequate to meet the requirements of the micro-organisms in the soil, and decomposition should be rapid with a minimum loss of nitrate. There was little variation in the results of analysis from the middle of February until near the end of March when the nitrogen, potash and phosphoric oxide values again dropped, the fibre rose and the carbon-nitrogen ratio widened. During this period of seven weeks when flowering had almost completed and most of the seed had set, the mean nitrogen content was 1.9 per cent. and the mean carbon-nitrogen ratio was 22.6. The final results show the nitrogen, potash and phosphoric oxide to have dropped appreciably, the fibre to have increased and the carbon-nitrogen ratio to have widened to over 30. The rainfall does not appear to have influenced the results of analysis; there is a drop in the nitrogen and fibre values for 1st March, but this was not of necessity due to the appreciable rain in the preceding fortnight.

Experimental: Season 1934-35.—The experiment was continued for a second season in a modified form. Ten small plots (1/30th acre) were taken in a maize rotation and planted with sunnhemp on the 3rd December, 1934. Commencing when the crop was two months old and just coming into flower, one plot was ploughed under each week and samples taken for analysis. The carbon and nitrogen content of the ten samples was determined. In addition soil samples were taken each week from the first plot to be ploughed under (Plot 1) and from a nearby piece of bare fallow land to serve as control. The soil from the plot ploughed under at what was considered, from the appearance of the crop, to be the optimum condition (Plot 4), and from the last plot to be ploughed under (Plot 10) were also sampled. These samples were taken at intervals throughout the dry season and the total nitrogen and nitrate nitrogen determined on them. The total rainfall for the season was 34.1 inches, of which only 7 inches had fallen before the crop was planted.

TABLE I.

Analyses of Sunnhemp: Planted 15/11/33.

Data of Sampling.		24/1/34	1/2/34	8/2/34	15/2/34	22/2/34	1/3/34	8/3/34	15/3/34	22/3/34	29/3/34	5/4/34
Rainfall during preceding week. Inches		1.82	1.48	—	0.25	1.86	2.69	0.05	0.02	0.32	—	—
Carbon	%	39.9	42.1	39.6	42.6	41.5	41.0	41.9	43.4	42.7	44.0	45.4
Nitrogen...	%	3.0	2.9	2.2	1.9	2.0	1.7	1.8	1.8	1.9	2.1	1.5
Potash (K_2O)	%	2.5	2.4	2.8	1.6	2.0	1.9	1.6	1.2	1.6	1.5	1.2
Phosphoric Oxide (P_2O_5)	%	0:57	0.50	0.42	0.45	0.49	0.42	0.38	0.28	0.29	0.27	0.22
Fibre...	%	30.8	36.1	40.5	48.3	44.2	42.3	43.2	45.1	42.5	44.3	46.3
C/N Ratio		13.13	14.5	18.0	22.4	20.8	24.1	23.3	24.1	22.5	21.0	30.3



Anlyses of Sunnhemp.—The results of analysis (Table II.) show that the carbon content of the sunnhemp varied slightly and irregularly as the crop grew more mature. The nitrogen content remained steady at just above 2 per cent. for the first three weeks, then dropped to 1.8 per cent. for the next two weeks, and dropped further after that, remaining fairly constant between 1.5 and 1.6 per cent. for the next five weeks.

Soil Analyses.—It was found from soil analyses that little change takes place in the total nitrogen content from the various plots. The results for nitrate nitrogen (Table III.) are of more interest. At the time of ploughing under the sunnhemp the nitrate nitrogen on each of the three soils analysed was practically nil, showing that the growing crop had utilised all the nitrate in the soil. On the first plot it then rose slowly for the first four weeks to 1 mgm per 100 gms, then to over 4 in the fifth week. It fluctuated between 2.5 and 4 until the thirteenth week, and then dropped slowly to 2 after 21 weeks. On the plot ploughed under at optimum time the behaviour was similar for the first five weeks, and after the nitrate content had risen, it remained between 5.5 and 7.0 mgm per 100 gms throughout the dry season. On the last plot to be ploughed under when the crop was coarse and fibrous, the nitrate content rose very slowly to 1 mgm

TABLE II.

Analyses of Sunnhemp: Planted 3/12/34.

Date of Sampling.		5/2/25	12/2/35	19/2/35	26/2/35	5/3/35	12/3/35	19/3/35	26/3/35	2/4/35	9/4/35
Rainfall in preceding week. Inches		2.72	1.35	.18	.08	—	—	1.96	.54	.48	.03
Carbon...	%	44.2	46.4	46.7	45.7	45.7	46.8	45.3	47.6	45.2	44.8
Nitrogen	%	2.13	2.01	2.08	1.82	1.78	1.57	1.53	1.55	1.59	1.50
C/N Ratio...		20.7	23.0	22.2	25.6	25.6	29.9	29.6	30.6	28.4	30.0

TABLE III.

Nitrate Nitrogen in Soil after Ploughing under Sunnhemp.

(mgm. per 100 gms soil).

Weeks after ploughing under	0	1	2	3	4	5	7	8	9	11	12	13	14	17	18	21	23
Control from 5/2/35...	1.2	1.3	1.2	.9	.8	2.3	1.4	—	.8	1.2	—	2.0	—	2.5	—	1.7	—
Plot 1, P.U. 5/2/35 ...	.06	.25	.6	1.0	.7	4.3	3.4	—	2.1	3.2	—	4.4	—	3.5	—	2.1	—
Plot 4, P.U. 26/2/35	.03	.2	.5	.8	1.4	2.9	4.8	—	2.3	5.7	—	—	6.6	—	5.4	—	6.9
Plot 10, P.U. 9/4/35	Nil	—	.07	—	.4	—	—	1.0	—	—	1.1	—	—	1.0	—	—	—

per 100 gms and remained at that figure throughout the season. On the bare land there was little change in the nitrate nitrogen, the values starting at just above 1 mgm per 100 gms and rising to 2.5. These changes are clearly seen in the accompanying graph.

Examination of the crop from time to time after it was ploughed under showed that decomposition was most rapid in the first plot and after four months there was little evidence of the crop at all. On the plot ploughed under at optimum time, decomposition proceeded satisfactorily, but after six months the fibrous shell of the stalks was still to be seen. On the last plot very little decomposition took place and the crop was still largely undecomposed at the end of October.

Conclusions.—An examination of the experimental data obtained in the two seasons shows that the conclusions obtained by workers in Britain and America are applicable to green manuring in this country. From the results of the season 1933-34 it would seem that sunnhemp could be ploughed under any time after fourteen weeks' growth and before twenty weeks. From the appearance of the crop the actual time chosen in that season by the Manager of the Experiment Station was after sixteen weeks' growth. From a theoretical consideration of the results of the season 1934-35 the correct time to plough under the crop would be twelve or thirteen weeks after planting. In practice the twelfth week was the period chosen.

The soil analyses show that when a green crop is ploughed under in a young succulent condition, decomposition is rapid and nitrates are liberated in the soil. These, however, tend to be lost from the soil before they can be utilised by the subsequent crop. Ploughing under at the optimum stage of growth results in slower decomposition, but there is not the same loss of nitrates. Little decomposition takes place when a mature crop is ploughed under, and owing to its low nitrogen content it is very likely that the micro-organism effecting decomposition in the following season will require to draw on soil nitrates for this purpose to the detriment of the crop then growing.

In practice other factors have to be taken into consideration, chief of these being rainfall and the subsequent long dry season. For satisfactory decomposition of green manure the soil must be reasonably moist, and in seasons such as 1934 when there was practically no rainfall after the end of February, crops ploughed under in March and later, even if of suitable composition, would not be adequately incorporated in the soil. It is therefore considered advisable that the crop be ploughed under as soon as possible after it is in full flower at about three months from planting. This is in general accord with theoretical considerations and practical observations.

REFERENCES.

Russell: Soil conditions and Plant Growth. 6th Edition.

(1) Waksman and Tenney: Soil Science, Vol. 24, p. 317, 1927

(2) Lyon, Bizzell and Wilson: Journal American Society of Agronomy, Vol. 10, p. 313, 1918.

(3) Russell: Farmers' Guide to Agricultural Research in 1931, p. 177.

(4) Jensen: Journal of Agricultural Science, Vol. 19, p. 71, 1929.

(5) Gilbert and Pember: Soil Science, Vol. 35, p. 115, 1933.

KRAAL MANURE.

A SIMPLE METHOD OF INCREASING THE SUPPLY.

By S. D. Timson, M.C. (Assistant Agriculturist).

In an article published in the February, 1936,* issue of this journal a new method whereby the supplies of kraal manure on a farm may be simply and very greatly increased was advocated. This consists, in a few words, of the growing of sunnhemp, and cutting and placing in the cattle kraals of the top-growth when the crop has reach the full flowering stage.

A farmer near Matopos put this system into practice this year with great success, and he is so pleased with the results that he is extending his use of it in future.

Three acres of sunnhemp were sown in January (owing to the lateness of the season), and in March the crop was cut and placed in a kraal in which 80 head of cattle slept each night. This was done at such a rate that the cattle had no difficulty in keeping the sunnhemp trampled underfoot.

Four to five weeks later the manure was dug and ridden to the wheat lands, and it was found that the sunnhemp had rotted so well that no sign of it was visible in the manure. The kraal contained no manure before the sunnhemp was cut and put in it, and when it was emptied it was estimated by the number of wagon-loads removed to contain 90 tons of manure. This, in the farmer's opinion, was more than three times the quantity of manure made in the same period previously.

The farmer was particularly impressed with the quality of the manure made by this system, and it is a well-established fact that the higher the nitrogen content of the vegetable matter converted into manure or compost, the higher is the content of nitrogen of the finished product, within certain limits.

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The manure from this kraal was spread and ploughed under in April on 14 acres of wheat land under irrigation, the soil being a heavy grey sticky loam. A dressing of superphosphate was also applied to the land before sowing the wheat.

Reward and Karachi wheat was sown broadcast on this field, the former on the 16th June, and the latter on the 20th June, and when seen by two experienced officers of this Department in late August was described as "looking really magnificent," and estimated to yield not less than 10 to 12 bags of wheat per acre.

It should be emphasised that the sunnhemp was grown on a poor sandy soil, and naturally, therefore, the yield of top growth was on the low side. On the better soils in the Colony, and in the warmer areas, the yield of sunnhemp, and therefore of finished manure, would certainly be much greater.

This is a cheap and easy way of increasing both the quality and quantity of the supplies of farm manure, which every farmer can be strongly advised to adopt without delay, and particularly the wheat farmers, who farm the poor wet sandy vleis of the Colony.

All Rhodesian soils need the constant replenishment of humus, and especially humus manfuactured with the aid of animal excreta, since the latter is of particular value in ensuring the health of the crops, and also the health of the animals (including the human animals) fed on those crops.

The manure from the stock on the farm can be much more economically utilised in converting the vegetable wastes and green manures into compost by the method described in the article already mentioned above, since a much greater weight of compost per unit weight of animal manure can be made than by the system of simply placing the wastes in the cattle kraal.

The writer has little doubt, however, that the farmer who takes the first step of increasing his kraal manure supplies by the simple and inexpensive method described

above, will quickly go a step further and increase his supplies of organic manure still further by the manufacture of compost with the aid of the dung from his cattle and other stock.

Now is the time of year when his compost heaps should be ready and awaiting the advent of the seasonal rains, and every farmer is urged to make a start now in the manufacture of compost. Many farmers have already done so, and the benefits they will obtain in higher yields from healthier crops will, it is hoped, force their brother farmers to follow their lead.

The Flue Curing of Virginia Bright Tobacco

IN SOUTHERN RHODESIA.

ADVANTAGE OF THE USE OF RECORDING INSTRUMENTS AND DIRECT READING HYGROMETERS IN BARNS.

By W. F. Collins, A.R.S.M., Sometime National Scholar in Biology, Injina, S. Marandellas.

(*Concluded*).

At the beginning of the curing season avoidance of sponging is assisted by the smaller variation in moisture-content of the external air. Towards the end of the season the daily short-period high humidity accompanied by increased moisture-holding capacity of colder air must entail considerable risk of chill and consequent sponging, especially if the barn be equipped with an insufficient flue-surface. The matter of flue-surface is important, because it is essential to be able to dry a considerable volume of humid incoming air quickly when external conditions are unfavourable. In windy or rainy weather, and particularly when these two unfavourable conditions exist together, entailing rapid variation in ventilation, moisture and temperature at short intervals, defficient flue-surface is shown by the recording hygrometer to entail very great risk. The walls of the barn too absorb much heat and give out moisture. Brick barn walls readily become saturated with moisture in wet weather and are then sometimes found to be moist on the inside. The top barn-ventilators in Rhodesian barns are usually far too small. In drying out the leaf it is clearly of advantage to secure as free a passage as possible of external dry (dryer than the leaf) air as possible.

Conditions Inside the Barn.—The difficulty of curing with the help of the wet-bulb hygrometer only and in the light of knowledge then existing is illustrated by referring to a curing late in the 1931-1932 season.

External humidity being low there was extreme difficulty in maintaining high humidity during the yellowing stage. At 1 p.m. on Saturday the barn-boy (white supervision having been away reaping) had allowed the temperature to jump from 100 to 110 deg. with a corresponding drop in humidity from 98 to 85.5 Slight sponging was observed within two hours. At 11 p.m. further sponging was observed and still more on Sunday morning at 7 a.m.

In the light of present knowledge it may be remarked that the second and third sponging both took place at times at which the humidity curve of the external air must have been steep. Maintenance of excessive humidity by drenching the barn-floor and sides caused extraction of this moisture to be slow and to prolong the drying stage (say from the end of the 90 deg. period to the beginning of the 120 deg. period) to be 24 hours. At the end of this period the air humidity was still 80, a point passed 24 hours earlier in more recent practice. Partially stifled leaf was therefore subjected both to the caprices of the barn-boy and also to the risk, while at the critical stage, of damp external air during the Sunday night. Twenty hygrometer readings (and calculations) were made, and, though the curing was good on the whole, it was felt, in view of the knowledge that sometimes curing seems easy and almost automatic, that there must be little-understood factors at work.

It is believed that the use of the recording hygrometer and thermometer, coupled with the knowledge gained from the fortunate publication by the Rhodesian Government of the very valuable research of the Victoria Electricity Commission, have had considerable influence in the production of the very much higher proportion of bright leaf in the 1932-33 and subsequent crops. Fertiliser and the nature of the leaf were favouring factors for easy curing at the beginning of the 1932-33 season, but from the end of January the leaf was dry and might have been expected to be far more difficult to cure than proved to be the case.

Current Practice.—During 1932-33 season wetting of the cement barn-floors was discontinued in favour of a floor-covering of moistened hessian.

Maintenance of saturation in the barn was quickly found to be not necessary. The leaves were sprinkled with water before stringing. Damp hessian was spread on the floor and wet sacking was placed on the flues. With water-ripe leaf humidity as low as 75 deg., and even 65 during yellowing, was found to be adequate.

Humidity Control.—By a quick raising of the temperature of the barn during the period of falling external humidity it was found possible to secure a series of nearly fifty almost "perfect" curings during the early and rainy part of the curing season, the leaf being rather light-bodied and susceptible of quick and easy curing.

The chart shows the automatic records of temperature and humidity of a barn worked in a manner which was adopted as standard for the rest of the season. The period of yellowing of the leaf (and high humidity in the barn) was made to be near its close at about 7 a.m., say, 34 hours after filling the barn. The temperature was then raised 10 deg. to 95 deg. F., and afterwards 5 deg. each three hours. Both bottom and top ventilation of the barn were increased to the utmost from 9 a.m. To secure this all bottom ventilators, and even the door, were opened, with the result that by evening the temperature was near 120 deg., the leaf-web fairly dried out and the risk of condensation from external air, however moist, almost negligible. The "critical" or drying stage (90 to 120 deg.) was thus reduced to about 14 hours during the least humid period of the day.

Modification of this practice was necessary in windy or wet weather, when green wood was used in firing and in curing the heavier leaf from the upper part of the plant. The recording hygrometer gave invaluable information as to the state of moisture of the incoming air. So long as a steadily descending curve was maintained there was no risk of sponging.

With a still heavier application of fertiliser in 1933-1934 it was found that a heavier-bodied leaf was secured and that the yellowing period at 90 deg. had to be extended. During this season the wetting of the barn-floor was abandoned entirely in favour of spraying of the walls with a more efficient spray pump. The temperature of the barn was raised to 100 deg. when yellowing was approximately complete. After two or more hours the damp sacks were removed from the flues and all vents opened full. At this point there was usually a drop of 10 to 20 deg. of relative humidity in the supply air within the barn. The temperature was then raised gradually to 110 deg. After three or four hours the temperature was raised to 120 and left at this point for six hours until the web of the leaf was dry.

The leaf thus cured was sufficiently heavy-bodied to average a satisfactory price on the London market. The heavier leaf of the middle and top of the plants was apt to take longer in the yellowing stage, usually carried out at 90 or even 100 deg. instead of 85 deg.

It should be noted that the hygrometer records were taken on air before it reached the leaf hanging in the barn, one instrument only being in use.

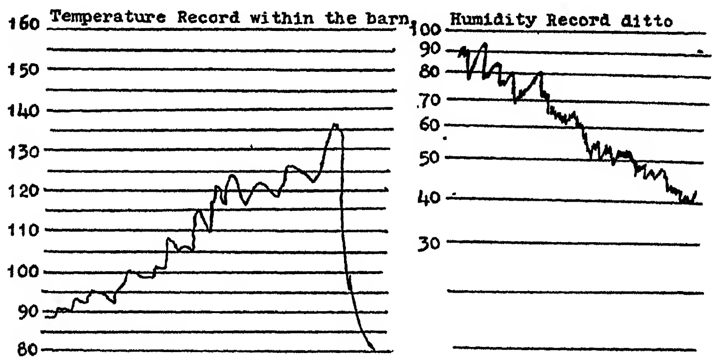
It has not been possible to take a simultaneous record on air at the outlet vents. Presumably an outlet humidity curve record of the speed of drying. A sudden drop in humidity would have been equally valuable. It would have given a would have been registered towards the completion of drying-out of the web of the leaf and thus should have indicated clearly the point at which temperature could be raised rapidly to proceed with the drying-out of the stems at, say, 150-160 deg.

AIR CONTROL.

Yellowing Stage.—Breathing air was admitted from the time the barn was filled. It was found that the bricking up of two 18 in. x 18 in. inlets loosely enough to allow a slow current of air to pass, with the roof vents closed or slightly open, gave sufficient breathing air without dangerously diminishing the humidity. The leakage of air between the wall-top and the overlying corrugated iron is considerable.

The use of sliding doors for bottom ventilators is considered inadvisable on account of the risk of intereference by barn-boys and others. Towards the end of yellowing, with some leaf still slightly green, the temperature was raised slightly, say, from 90 to 95 deg. in order to secure a moderate fall in the humidity of the air and to prepare for rapid increase of temperature to balance that of the external air on opening the lower vents.

Drying Stage.—The air-inlets and barn doors were opened as full as possible consistent with securing a regularly rising temperature curve on the recording thermometer and a similarly falling curve on the hygrometer. The roof ventilators, doubled to four in number, were opened full.



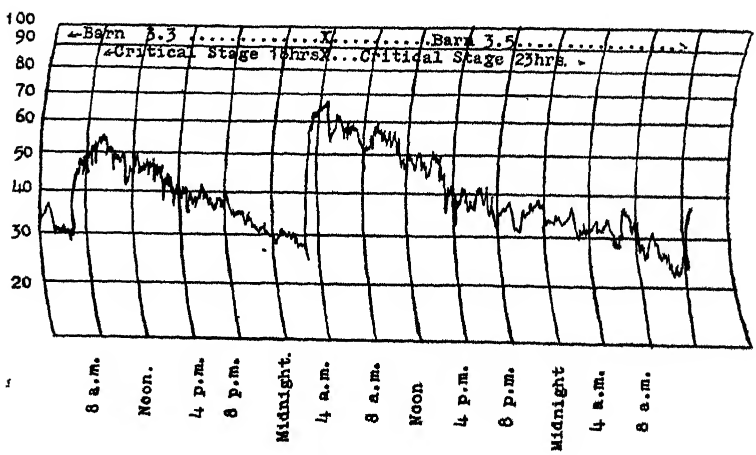
During the 1933-1934 season both roof and bottom ventilators were opened full from the beginning of drying period. The door of the barn was also left ajar or opened as wide as possible consistent with existence of a steady stream of air from the bottom ventilators. After the drying at 120 deg. the temperature was raised 10 deg. every three hours until 160 deg. was reached. This rapid rise was facilitated by closing the inlet vents to half capacity at the later stage. After, say, twelve hours at 160 deg. the outlet vents were closed until completion of drying-out of the stems, about 42 hours later.

The hygrometer proved itself to be the more useful of the two recorders. A straight-line hygrometer curve sloping at an angle of about 45 deg. indicated that all three factors—temperature, ventilation and moisture—were reacting in a satisfactory manner and that the barn-boy's duties had been properly performed.

The recording hygrometer assists very considerably in securing adequate control in both the yellowing and drying-out processes. The formula of curing any particular grade of leaf characteristic of the season or of the height on the plant, can be quickly ascertained and, in similarly constructed barns, standardised for future curings. The planter thus receives the service of a reliable assistant capable of relieving him of some of his greatest anxieites.

Towards the end of the 1933-1934 season drought caused a large proportion of the leaves to cure unevenly. Greenness, ripeness and over-ripeness were sometimes observed on one and the same immature leaf, which was small and lacking in moisture. The production of "perfect" curings of such leaf was obviously impossible, but the management had the satisfaction of feeling certain where the trouble lay, the indicators having shown that normal procedure had been faithfully carried out.

During the 1934-1935 season these findings were tested and confirmed in a fresh set of barns on the author's farm. On heavy end-of-season leaf, resulting from very low topping, good results were secured by pre-curing for 24-36 hours at 80 deg. At this temperature it is easy to maintain a saturated atmosphere. Such leaf, it was found, could be picked when still slightly green. Barn-ripening, it was found, was quicker and entailed less risk of disease.



Hygrometer records of inlet air during the critical period from 85 deg. Fahr. to 120 deg. Fahr. in two successive curings in different barns, resulting in bright leaf with no sponging. (Early 1933-1934 season).

It will be noted that towards the end of the "critical stage" the humidity was near 30 per cent. as against approximately 80 per cent. under previous practice.

CONCLUSIONS.

1. Price and saleability of flue-cured tobacco are mainly dependent on the colour of the cured leaf. Therefore curing, to the perfection of which but little research has been devoted in this country, is probably the most important of the problems confronting the tobacco planter.

2. Climatic conditions in Rhodesia differ, mainly on account of its exceptional altitude, from those in the United States, Canada, China and other low-altitude bright tobacco countries. The range of daily as well as seasonal humidity and temperature variations is very wide. Consequently curing is attended by special difficulties in this country.

3. Humidity, temperature and carbon-dioxide control within the barn have not been sufficiently studied, with the result that there is vast diversity in curing practice and an undue proportion of discoloured and low-quality leaf is produced.

4. Greater attention to humidity conditions, both outside and within the barn, aided by direct-indicating hygrometers and instruments giving a record of humidity and temperature conditions throughout each curing, can do much to assist the grower in securing consistent and more satisfactory results.

5. When the uncertainties of curing have been brought under control a number of the field-problems of the grower become more easy of solution and grading is facilitated.

6. A recording thermometer is useful as providing a record of actual barn-temperatures maintained by the barn-boy during curing. Its practical value is not so great, however, as that of a recording hygrometer. This latter instrument provides a record which is the resultant of moisture and heat-control combined. The recording hygrometer therefore is the more useful of the two instruments.

Report on Fire-Cured Tobacco Experiments, 1935-36.

By C. E. Strickland, B.Sc., Agric. (Lond.).

(Publication approved by Tobacco Research Board).

The scheme of experiments for this season was as follows:—

1. Potash.
2. Nitrogen (*a*) Little Crittenden.
   (*b*) Western.
3. Distance Planting (*a*) Little Crittenden.
   (*b*) Western.
4. Varieties.

Seed beds were arranged with a view to planting, if possible, the potash plots (4 acres) and distance planting plots (2 acres) between the 15th November and 7th December; the nitrogen plots with Little Crittenden (4 acres) and the variety plots (2½ acres) between 7th and 31st December, and the nitrogen plots with Western about mid-January.

In this way harvesting would have been spread out to suit barn accommodation and field work would have been simplified.

Actually, owing to the unsatisfactory season, planting had to be carried out whenever opportunity occurred, and although adequate provision was made for plants to be available for each experiment in a normal season (no less than 60 seed beds were sown) it was often difficult to find suitable plants when planting had to carried out. This naturally affected the health and growth of the plants in the field and detracted from the value of the experiment in some cases. Few really good planting days occurred, and when they did were often followed by a long dry period, thus giving the plants a check from the first.

The variety plots were the only ones of which it could be said that both weather and seed plants were right and which grew away without a check. The significance of this will be apparent in the yields obtained from them.

Distance Planting.—Five distances of planting were carried out, 2 ft., 2 ft. 6 in., 3 ft., 3 ft. 6 in., 4 ft. apart in the rows, the latter in each case being 3 ft. apart. Four or five rows of each distance were planted in series and repeated. From this method it was not possible to deduce results of any great value, such as could be obtained by planting in, say $\frac{1}{4}$ acre plots. Where five rows of each distance were planted the two outside rows had to be discarded and only the three centre taken into account, and as so small an amount could not be treated separately in the barn, only the green weight could be ascertained. For the same reason nothing can be said about the effect on quality of the different planting distances, but from observation in the field the closer plantings seemed to be equal both in size of leaves and body as the wider. The growth was remarkable even when planted as closely as 2 ft. apart in the rows, and the green weight of the rows weighed was the greatest with the closest planting both from Little Crittenden and Western. It might be thought that much damage could be done in working amongst the plants, but though this had to be done with great care, natives having to crawl along beneath the leaves and reach upwards for suckering, actually the damage was insignificant.

The yield green weight, from the different distances, was as follows:—

Little Crittenden ($1\frac{1}{3}$ *acres*).

2′	933 lbs.	from approx. 780	sq. yds.	=5,789 lbs.	per acre.
2′ 6″	814 lbs.	,,	,,	=5,051 lbs.	,,
3′	512 lbs.	,,	,,	=3,177 lbs.	,,
3′ 6″	653 lbs.	,,	,,	=3,793 lbs.	,,
4′	562 lbs.	,,	,,	=3,487 lbs.	,,

It will be seen therefore that the yield, green weight, is in direct proportion, with one exception, to the closeness of planting. The total cured weight from $1\frac{1}{3}$ acres, including the lines discarded from the point of view of the experiment, was 995 lbs., or 746 lbs. per acre.

This plot was planted on the 19th December, having been previously fertilised with 300 lbs. per acre Tobacco No. 4. Plants were uneven in size, and badly checked after planting by unfavourable weather conditions, so that many plants flowered too low, and ripening was very uneven. The plot was badly attacked with frog-eye and the quality mostly very poor.

Western (1 acre).

					(green weight).	
2′	697 lbs.	from approx.	570 sq.	yds.	=5,918 lbs.	per acre.
2′ 6″	658 lbs.	,,		,,	=5,587 lbs.	,,
3′	645 lbs.	,,		,,	=5,477 lbs.	,,
3′ 6″	570 lbs.	,,		,,	=4,840 lbs.	,,
4′	515 lbs.	,,		,,	=4,373 lbs.	,,

In this plot the seedling plants and planting conditions were better, the stand was very good, and plants grew out well. Although planted only a short time after the Little Crittenden, there were much less affected by spot, and quality was better. The yield from the plot (1 acre) was 1,087 lbs. of cured leaf. Fertiliser, as before, was 300 lbs. per acre Tobacco No. 4.

Potash.—Sixteen plots of ¼ acre each were laid out comprising four treatments in quadruplicate as follows, all plots having first received a standard dressing of 150 lbs. per acre superphosphate and 75 lbs. per acre sulphate of ammonia.

A (4 plots).—No potash.

B (4 plots).—50 lbs. per acre of a mixture in equal parts of sulphate and muriate of potash.

C (4 plots).—100 lbs. per acre of the potash mixture.

D (4 plots).—150 lbs. per acre of the potash mixture.

The plots were first planted on 23rd November with Little Crittenden, but after three weeks' hot dry weather the stand was so poor that all the surviving plants were grubbed out and the plots replanted on 19th December. The stand from this planting was good, but the plants uneven in size and some too old and woody. A further period of dry weather gave them a check, and by the time the rains began to fall in earnest early in February some were already coming into

flower too low. During February there was only one day without rain, and though the plants grew apace, spot developed and could not be checked, although all the affected lower leaves were carted off the field whenever an opportunity of a few hours dry weather occurred. This very seriously affected the quality of what looked at first to be a very promising crop. At no time could any difference be noticed in the field as regards growth, colour, body, affection by spot, or order of ripening. In giving the following results from these plots it cannot be too much emphasised that definite conclusions cannot be arrived at from the results of one year's experiments, particularly in a year of unfavourable weather conditions such as the last. The yield per acre of these plots was:—

A. No Potash.	B. 50 lbs. Pot. mixture.	C. 100 lbs. Pot. mixture.	D. 150 lbs. Pot. mixture.
686 lbs.	728 lbs.	805 lbs.	804 lbs.

The plots were so damaged by spot that a large proportion of the leaves throughout were of very poor quality. It is interesting to note that the proportion of leaves of wrapper quality over 22 inches increased with the increase of potash, while the proportion of very short leaves, under 18 inches, decreased. By wrapper quality it is not necessarily meant that the leaf could be sold as wrapper, since even the best was more or less damaged by spot.

	A. lbs.	B. lbs.	C. lbs.	D. lbs.
Leaf of wrapper quality over 22 inches	67	86	147	161
Leaf of wrapper quality under 18 inches... ...	55	64	10	Nil

The greatest amount of the best quality was 18 inches-22 inches and was approximately the same for all plots. The most that can be said from these results is that under the particular weather conditions of this season there appeared

to be some little advantage in the addition of potash up to 100 lbs. per acre to the standard mixture of supers and sulphate of ammonia, but again it must be emphasised that in a normal season with well distributed rainfall quite different results might be obtained and the yield of the non-potash plots approach more nearly to that of those receiving potash. At the same time it must not be overlooked that the additional cost of the potash applications only amounts to about 6s. 3d. per acre in the case of the B plots, 12s. 6d. for the C plots and 18s. 9d. for the D plots based on the approximate landed cost at Shamva for small quantities of potash fertilisers.

Nitrogen Experiment.—The object of this experiment was to test the value of an equal quantity of nitrogen applied as sulphate of ammonia, or as bloodmeal, or as a mixture of both. Sixteen ¼-acre plots were laid out both for Little Crittenden and for Western according to the following plan. A standard dressing was first applied throughout of supers at the rate of 150 lbs. per acre, and the potash mixture was used for the potash experiment at the rate of 50 lbs. per acre.

Four Plots.

(A) received no nitrogen.
(B) received 100 lbs. per acre of sulphate of ammonia.
(C) an equivalent quantity of N. in the form of bloodmeal.
(D) received an equivalent quantity of N., half of sulphate of ammonia, half as bloodmeal.

With Little Crittenden.—It is not found possible, owing to the weather, and the necessity for re-planting the potash plots, to plant these plots until the 10th January, by which time the majority of the seedlings had become too old and woody. Very little rain fell after planting till February, so that the stand was not very good and the plants got a poor start. With the February rains they started growing, but reached no great size, and were soon invaded by spot. The stand was also much deflected by mosiac, curly leaf, and eelworm. The earlier planted plots where plants were younger and softer at planting time were very little affected by any of these latter pests. By

Plot of Western from Lion's Den Seed, 1936.

constant removal and carting off of leaves affected by spot whenever a few hours of sunshine allowed the disease was got under better control than was the case with the larger plants on the potash plots. The season was not favourable to a nitrogen experiment, these plots having experienced first three weeks' dry weather after planting, followed by 30 days of almost continuous rains and saturation of the soil, after which the rains ceased abruptly and hot dry weather followed. Such conditions were not suitable for nitrification and assimilation by the plants of the fertilisers applied. Consequently no results of any great value could be expected. There was practically no tobacco over 22 inches in length in these plots; leaf of 18-22 inches in length was of fairly good quality, but there was a large amount of short leaf under 18 inches in length, especially from D plots.

The results obtained were as follows:—

	Wrapper over 22 inches.	Wrapper, grades 1 and 2 18-22 inches	Grade 3, poor quality.	Under 18 inches.	Total yield per acre.
	lbs.	lbs.	lbs.	lbs.	lbs
A No nitrogen...	12	331	184	57	584
B 100 lbs. per acre sulphate ammonia	18	387	199	48	652
C Equal quantity N. as bloodmeal	11	305	222	60	648
D Equal quantity N., ½ sulphate ammonia, ½ bloodmeal ...	Nil...	318	170	180	668

With Western.—Plots were laid out and treated exactly as with the Little Crittenden. At one time it seemed doubtful whether the rains would come in time to allow planting to be done before the plants from the last of the seed beds became

too old. This was carried out, however, on the 6th February at the beginning of the wet spell. The plants on the whole were good and grew away from the start. They very soon became affected with spot from the neighbouring Little Crittenden plots, but the disease was got under control and checked. These plots suffered from the opposite condition from the Little Crittenden plots. The land was lower lying than the latter, and during February water was in some places lying for days on the surface, causing some plants to become yellow and stunted. On the whole, however, these plots looked very promising and would have given heavy yields but for the abrupt cessation of the rains and subsequent baking of the land. Little reliable information can be deduced from the following results:—

	Over 22 inches. 1st & 2nd grade.	18-22 inches. 1st & 2nd grade.	3rd Grade.	Under 18 inches.	Total per acre.
	lbs.	lbs.	lbs.	lbs.	lbs.
A No nitrogen...	22	231	287	44	584
B 100 lbs. per acre sulphate of ammonia	63	267	283	56	624
C Equal quantity nitrogen as bloodmeal...	60	391	162	38	651
D Equal quantity nitrogen, ½ as sulphate, ½ as bloodmeal ...	64	371	150	34	619

A heavier yield might have been obtained from these plots but for the fact that they were over-ripe when harvested owing to want of barn accommodation. The number of barns is too limited to deal with so many plots separately to the best advantage.

Varieties.—Ten varieties were sown and planted on twenty one-eighth acre plots. These were:—

Western.—Single plant selection 1.
,, — ,, ,, ,, 2.
,, —Lion's Den seed.
L. Crittenden.—Single Plant Selection 1.
,, — ,, ,, ,, 2.
Western-L. Crittenden Cross Type 1.
,, ,, ,, ,, 2.
,, ,, ,, ,, 3.
Lizard Tail Orinoco.
Greenwood.

These were planted on the 15th January, under conditions favourable both in weather and for the most part in plants. The stand throughout was almost perfect, and the plants grew out well from the start. Fertiliser used was Tobacco No. 4 at the rate of 300 lbs. per acre. Speaking generally, the following facts are noticeable. The Little Crittenden plots were fully ripe at least three weeks before the Western, followed about ten days later by the Western and Little Crittenden crosses; Westerns and Lizard Tail Orinoco came next and Greenwood last. Little Crittenden and Little Crittenden crosses were much more affected by spot than the Western types. Taking the varieties individually—

1. Little Crittenden Single Plant Selection No. 1. Two Plots.—Seedlings at planting time of this were rather tall, though they had not become woody. A good deal of the stems was buried at planting; consequently though growth was good the plants reached no great height, the leaves tended to remain extra narrow, as often happens when plants are topped too high. Plants were very uniform in type, early in ripening and even. They were, however, badly affected by spot. The yield was at the rate of 796 lbs. per acre, of which 37.5% was of very poor quality; the rest would have been good except for spot.

2. Little Crittenden, Single Plant Selection, No. 2. One Plot.—Seed of this was scarce, sufficient for one sowing only, and as by the time of planting the plants from the first sown seed beds of all the varieties were much too big, no good seedlings

Southern Rhodesia Weather Bureau.

SEPTEMBER, 1936.

Pressure.—Mean barometric pressure over the whole country was well above normal.

Temperature.—Mean monthly temperature were considerably below normal and frosts were recorded in the screen at Inyanga and Stapleford.

Rainfall.—On the whole rather less than the usual rainfall was recorded.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	95	45	81.6	54.8	68.2	70.9	67.4	58.5	59	53	...	0.00	0.14	...	...
Beitbridge...	969.5	..	97	44	83.2	56.4	69.8	...	67.4	56.9	52	49	2.6	0.00	0.18	.	1,500
Bindura...	895.0	...	92	43	80.2	53.6	66.9	...	64.3	55.2	56	48	1.2	0.05	0.13	1	3,700
Bulawayo	872.7	871.6	87	40	77.3	50.7	64.0	67.5	62.3	50.7	44	40	0.6	0.00	0.17	...	4,393
Chipinga	896.4	...	88	43	73.6	51.2	62.4	...	63.5	55.2	61	49	2.7	0.29	0.79	3	3,685
Enkeldoorn...	860.7	...	86	37	76.2	47.7	61.9	67.0	62.3	51.2	47	41	1.5	0.00	0.14	...	4,788
Fort Victoria	899.7	897.6	91	37	77.7	49.6	63.7	66.1	64.1	54.3	54	46	1.3	0.00	0.21	...	3,571
Gwaai Siding	907.2	...	95	38	86.9	49.2	68.1	...	66.7	54.4	44	44	0.4	0.00	0.17	...	3,278
Gwanda...	910.2	...	90	42	79.2	52.2	65.7	...	66.1	53.5	43	43	1.6	0.00	0.16	...	3,233
Gwelo	865.4	...	87	42	76.7	49.2	62.9	67.4	61.5	50.9	49	42	1.3	0.00	0.17	...	4,629
Hartley...	888.5	...	90	39	81.7	49.9	65.8	70.1	65.2	53.8	47	44	0.6	0.00	0.13	...	3,879
Inyanga...	839.8	...	84	30	72.4	45.7	59.0	...	62.1	51.2	48	40	1.0	0.21	0.24	1	5,503
Marandellas	840.4	...	81	38	72.9	48.5	60.6	...	59.1	50.2	55	42	1.7	0.22	0.27	1	5,453
Miami	881.7	...	91	44	79.1	51.9	65.5	..	64.8	55.1	54	48	0.8	0.35	0.00	1	4,090
Mount Darwin ...	911.2	...	94	40	81.8	52.3	67.1	..	66.7	57.6	58	51	2.1	0.20	0.06	1	3,179
Mount Nuza	804.2	...	76	33	59.2	44.3	51.7	...	51.4	45.8	69	41	4.6	0.84	0.90	6	6,668
Mtoko	880.5	...	89	45	76.6	53.7	65.2	...	65.0	54.6	52	46	0.8	0.09	0.02	2	4,141
New Year's Gift...	...	...	95	37	79.8	52.1	66.0	...	64.5	56.5	61	51	...	0.05	0.25	2	2,690
Nuanetsi	967.1	...	97	40	83.2	51.8	67.5	...	69.5	58.4	52	51	2.3	0.00	0.21	...	1,581
Plumtree	867.4	...	87	40	77.2	52.6	64.9	..	63.7	50.5	38	37	0.6	0.00	0.03	.	4,549
Que Que	885.1	...	90	40	80.8	51.2	66.0	...	64.3	52.9	47	43	1.2	0.00	0.07		3,999
Rusape	865.5	...	85	39	74.7	47.2	60.9	..	61.2	52.0	55	44	2.0	0.00	0.14	...	4,648
Salisbury	859.1	858.3	86	38	77.6	48.4	63.0	66.6	63.5	51.7	45	41	1.0	0.00	0.27	...	4,831
Shabani...	914.1	...	93	41	79.0	52.8	65.9	...	66.4	55.6	51	47	2.0	0.00	0.24	.	3,131
Sinoia	891.4	...	92	41	82.1	49.5	65.8	...	66.2	54.7	48	45	0.8	0.00	0.19	...	3,795
Sipolilo	888.2	...	90	44	79.2	54.0	66.6	...	67.3	56.0	49	48	0.5	0.13	0.10	1	3,876
Stapleford	845.3	...	81	29	66.6	43.2	54.9	...	56.8	51.4	72	47	3.1	0.72	0.79	6	5,304
Umtali	896.7	895.5	90	39	77.1	51.6	64.4	67.4	63.2	55.1	62	49	3.1	0.11	0.43	2	3,672
Victoria Falls... ...	914.9	...	96	...	88.8	...	...	...	71.4	56.9	39	46	0.0	0.00	0.05	...	3,009
Wankie	930.0	...	98	48	91.0	63.0	77.0	...	73.0	57.4	37	45	0.3	0.00	0.09	...	2,567

Southern Rhodesia Veterinary Report.

AUGUST, 1936.

FOOT AND MOUTH DISEASE.

No further outbreaks diagnosed. Inoculation Angus Ranch completed 11th August.

MALLEIN TEST.

Forty-three horses and 12 mules were tested upon entry and 3 horses upon exportation. No reaction.

TUBERCULIN TEST.

Four bulls and 15 cows were tested upon importation with negative results.

Two dairy herds, consisting of 91 animals, were tested during the month. Four cows which had previously given a suspicious reaction were re-tested with negative results.

IMPORTATIONS.

From the Union of South Africa.—Bulls 4, cows 15, horses 43, mules 12 and sheep 881.

From the Bechuanaland Protectorate.—Sheep 417.

EXPORTATIONS.

To the Union of South Africa.—Horses 3.

To Nyasaland.—Sheep 1.

EXPORTATIONS.—MISCELLANEOUS.

To the United Kingdom in Cold Storage.—Frozen boned beef quarters, 5,396; frozen beef quarters, 10,422; chilled beef quarters, 6,302; chilled pork carcases, 65; kidneys, 5,135 lbs.; tongues, 22,209 lbs.; livers, 30,658 lbs.; hearts, 1,910 lbs.; tails, 3,769 lbs.; skirts, 5,800 lbs.; shanks, 16,617 lbs.

Meat Products.—From Liebig's Factory: Corned beef, 220,452 lbs.; meat extract, 24,739 lbs.; beef powder, 102,231 lbs.; beef fat, 22,000 lbs.; meat meal, 52,000 lbs.; tongues, 1,800 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-36.

Monthly Report No. 46. September, 1936.

The Red Locust (*Nomadacris septemfasciata*, Serv.) has shown increased activity during September, and swarms have been reported in all parts of the Colony.

Most of the swarms have been described as "large" or "very large," and in some cases it has taken several hours for the swarm to pass over a fixed point.

The direction of flight has included most points of the compass and no particular trend has been apparent.

Some damage to winter crops has been reported.

No disease or parasite attack has been recorded.

Reports from territories to the north of the Colony indicate increased activity of this species of locust. This is the direction from which swarms have arrived to breed in the Colony during the present swarm cycle, and the outlook for the coming wet season is considerably less favourable than at this time last year.

RUPERT W. JACK,
Chief Entomologist.

Departmental Bulletins.

The following Bulletins are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

N.B.—The date the article appeared in the Journal is indicated in abbreviated form before the number, e.g., 8/22, No. 429, means that Bulletin 429 appeared in the Journal for August, 1922.

AGRICULTURE AND CROPS.

7/25. No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.

3/27. No. 630. The Storage of Seed Potatoes, by H. C. Arnold.

5/27. No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.

12/27. No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

2/28. No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.

2/28. No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.

3/28. No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.

6/28. No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

6/28. No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

9/28. No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

9/28. No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

10/28. No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

3/29. No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

3/29. No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

7/29. No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

9/29. No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

10/29. No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

1/30. No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

3/30. No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

11/30. No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

1/31. No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) London., Dip.Agric (Wye), Assistant Agriculturist.

3/31. No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

4/31. No 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.

5/31. No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

9/31. No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist

10/31. No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

11/31. No. 836. The Potato, by S. D. Timson, M.C , Dip.Agric. (Wye).

12/31. No. 837. Veld Grass Silage: A Feature in Rhodesian Pasture Management, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief, Division of Plant Industry.

1/32. No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulip Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

6/32. No. 855. Pigeon-hole Method of Stacking Maize, by Division of Plant Industry.

8/32. No. 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.

2/33. No. 878. A.I.V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.

11/34. No. 936. Witchweed, by S. D. Timson, M.C. Dip.Agric. (Wye), Assistant Agriculturist.

10/35. No. 970. Rhodes Grass for the Southern Rhodesian Tobacco Grower, by African Explosives and Industries, Ltd.

11/35. No. 972. Notes on Witchweed, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

2/36. No. 978. Organic Manure in Relation to Wheat Growing in Rhodesia: Its Importance and How to Produce It, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

3/36. No. 982. Weeds: Control of Weeds on Footpaths and Tennis Courts, by S. D. Timson, M.C., Assistant Agriculturist.

6/36. No. 992. Annual Report of the Agriculturist for the year 1935, by D. E. McLoughlin, Agriculturist.

7/36. No. 994. Some Notes on Cotton Growing, by J. E. Peat, Senior Plant Breeder, Cotton Station, Gatooma.

REPORTS ON CROP EXPERIMENTS.

7/27. No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

4/28. No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

7/29. No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

7/30. No. 789. Agricultural Experiment Station, Salisbury. Annual Report of Experiments, 1928-29, by H. C. Arnold.

TOBACCO.

LIVE STOCK.

1/35. No. 943. Cattle Improvement and a Cattle Breeding Policy in Southern Rhodesia: A Review of the General Position Chiefly as regards Ranching Cattle, by Dr. A. E. Romyn, Chief Animal Husbandry Officer.

1/35. No. 944. Pig Feeding Demonstration: The use of Balanced and Unbalanced Rations for Growing Pigs, by C. A. Murray, M.Sc. (Agr.), Senior Animal Husbandry Officer I/C., Matopo School of Agriculture and Experiment Station.

1/35. No. 945. A Home-made Cow Stanchion, by Major R. R. Sharp, Whinburn, Redbank.

3/35 No. 946. Economical Rations for Wintering Dairy Cattle, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Matopo School of Agriculture and Experiment Station.

5/35. No 952. Annual Report of the Chief Animal Husbandry Officer for the year ending 31st December, 1934, by A. E. Romyn, Chief Animal Husbandry Officer.

7/35. No. 959. The Selection of a Dairy Bull, by A. E. Romyn, Ph.D., Chief Animal Husbandry Officer.

3/36. No. 981 The Dehorning of Cattle intended for Slaughter and Export, by B. A. Myhill, Assistant Chief Veterinary Surgeon.

4/36. No. 984. Report on the Curing of Rhodesian Hides, by Advisory Committee on Hides and Skins of the Imperial Institute.

4/36. No 985. Export of Frozen Porkers. Third Consignment to Smithfield. Division of Animal Husbandry.

5/36. No. 987. The Curing of Hides and Skins on the Farm, by The Division of Animal Husbandry.

5/36. No. 988. Preparing Cattle for Show, by The Animal Husbandry Division.

6/36. No. 989 The Supplementary Feeding of Mineral and Protein Supplements to Growing Cattle in Southern Rhodesia and its Relation to the Production of Beef Steers, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate; A. E. Romyn, Ph.D., Chief Animal Husbandry Officer, Department of Agriculture, Southern Rhodesia; D. G. Haylett, Ph.D., Director, Rhodes Matopo Estate; F. Ericksen, Dip. Agric., Experimentalist

10/36. No. 1001. The Raising of Bacon Pigs, by A. E. Romyn, Chief Animal Husbandry Officer, and C. A. Murray, Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate, with a Veterinary Section by D. A. Lawrence, Director of Veterinary Research.

9/36. No. 1000. Sheep Management on the Mixed Farm, by R. H. Fitt, Animal Husbandry Officer.

DAIRYING.

1/28. No. 667. Farm Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.

3/29. No. 730. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.

12/30. No. 799. The Objects of Ripening Cream for Butter-making, and a few Hints on Cream Production, by F. Lammas, Dairy Officer.

4/31. No. 818. Farm Butter-making. Issued by the Dairy Branch.

9/32. No. 862. Cream Cheese, by F. A. Lammas, Dairy Officer.

3/33. No. 880. Dairy Tests and Calculations, by F. A. Lammas, Dairy Officer.

5/34 No. 922. Dairy Building in Southern Rhodesia: A Small Farm Dairy, by G. B. Gundry, A.I.Mech.E.

7/34. No. 926. Dairy Buildings in Southern Rhodesia. Cow Byre—Type II., by B. G. Gundry, A.I.Mech.E.

12/34. No 937. Gouda or Sweet Milk Cheese, by F. Lammas, District Dairy Officer.

2/36. No. 977. Notes on the Feeding of Dairy Cows during the Summer Months, by A. E. Romyn, Chief Animal Husbandry Officer.

6/36 No. 990. Southern Rhodesia Milk Recording Scheme.

VETERINARY.

10/14. No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.

4/25. No. 536. Inoculation of Cattle against Redwater and Gall Sickness, by Ll. E. W. Bevan, M.R.C.V.S.

12/25. No. 570. The Spaying of Bovines, by G. C. Hooper Sharpe, M.C., M.R.C.V.S., and M. H. Kingcombe, M.R.C.V.S.

6/26. No. 597. Suspected Poisoning of Stock: The Proper Procedure, by M. H. Kingcombe, M.R.C.V.S. (Lond.), and A. W. Facer, B.A. (Oxon.), A.I.C.

12/26. No. 618. Notes from the Veterinary Laboratory: Quarter Evil, by Ll. E W. Bevan, M.R.C.V.S., Director of Veterinary Research.

1/28. No. 666. Notes from the Veterinary Laboratory: Praemonitus—Praemunitus, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

4/29. No. 739. The Laboratory Diagnosis of Animal Diseases: A Note to Emphasise some Points in the Preparation and Forwarding of Specimens, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

10/29. No. 756. Parasitic Gastritis of Cattle, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

11/29. No. 760. A Note on Sheep Diseases in Southern Rhodesia, by D. A. Lawrence, B.V.Sc., Veterinary Research Officer, Department of Agriculture, Salisbury.

2/30. No 772. Notes from the Veterinary Laboratory: Ophthalmia, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

4/31. No. 819. Measles in Swine, by P. D. Huston, M.R.C.V.S.

10/32. No. 866. The Treatment of Intestinal Parasites of Sheep, by J. D. Coutts, D.V.S., M.R.C.V.S.

4/33. No. 886. A Preliminary Note on Contagious Granular Vaginitis in Southern Rhodesia, by D. A. Lawrence, B.V.Sc., Acting Director Veterinary Research.

5/34. No. 921. Myiasis (Screw-Worm) in Cattle in Southern Rhodesia, by D. A. Lawrence, Director of Veterinary Research, and A. Cuthbertson, Entomologist.

IRRIGATION, WATER SUPPLIES AND SOIL EROSION.

3/27. No. 633. The Cost of Pumping for Irrigation, by R. H. Roberts, B.Sc. (Eng.).

4/27. No. 640. Levelling for Irrigation, by Dr. W. S. H. Cleghorn, M.I.Mech.E.

11/27. No. 659. The Hydraulic Ram, revised by P. H. Haviland, B.Sc.

11/27. No. 660. Small Earthen Storage Reservoirs, by C. L. Robertson, B.Sc.

11/28. No. 668. The Water Act, 1927, by C. L. Robertson, B.Sc. (Eng.), A.M.I.C.E.

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6/30. No. 786. Low Concrete Dams, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.

2/31. No. 808. The Application of Water in Irrigation, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.

3/31. No 811. Irrigation Canal Structures, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.

8/32. No. 860. Soil Drainage and Utilisation of Vleis, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.

2/33. No. 879. Conditions Governing the Hire of Government Boring Machines.

8/33. No. 900. Three Types of Water Tank, by R. H. Roberts, B.Sc. (Eng.), A.M.I.C.E., Assistant Irrigation Engineer.

6/34. No 923. Soil Eroison, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).

6/35. No 956. Annual Report of the Division of Irrigation for the year ended 31st December, 1934, by P. H. Haviland, B.Sc. (Eng.), Acting Chief Irrigation Engineer.

8/35. No. 963. The Dangers of Soil Erosion and Methods of Prevention.

9/35. No. 964. The Use of Ditchers for Constructing Contour Ridges, by C. Tapson, Devondale, Concession.

9/35. No. 967. How to use an Engineer's or Farm Level, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).

12/35. No 973. Domestic Water Supplies and Sanitation on the Farm, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Irrigation Engineer (Matabeleland).

3/36. No. 980. Results from Glenara Soil Conservation Experiment Station, 1934-35 Season, by C. L. Robertson, B.Sc. A.M.I.C.E., Chief Engineer, Irrigation Division, and A. D. Husband, F.I.C., Chief Chemist.

8/36. No. 999. Lining an Irrigation Furrow, by R. H. Roberts, B.S., A.M.Inst.C.E., Assistant Irrigation Engineer.

FORESTRY.

1/26. No. 575. Tending of Eucalyptus Plantations, by A. S. Thornewill, B.A.

11/29. No. 763. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.

1/30. No. 769. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.

4/30. No. 778. The Utilisation of Wood in Southern Rhodesia—Conversion and Disposal of Timber, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.

8/30. No. 791. The Utilisation of Wood in Southern Rhodesia: Fencing, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.

2/31. No. 809 Establishing Pines: Preliminary Observations on the Effects of Soil Inoculation. Issued by the Division of Forestry.

4/31. No. 817. The Raising of Forest Seedlings and Transplants on the Farm, by E. J. Kelly Edwards, M.A., Dip.For. (Oxon.), Acting Chief Forest Officer.

7/32. No. 857. Charcoal Burning on the Farm, by R. J. Allen, Forester, Rhodes Matopo School of Agriculture and Experiment Station.

11/32. No 869. Wind-breaks and Shelter Belts, by A. A. Pardy, B.Sc., Forestry.

1/33. No. 874. Tree Planting, by the Division of Forestry.

4/33. No. 888. The Vegetable Ivory Palm (Hyphoene ventricosa), by G. M. McGregor, B.Sc., District Forest Officer, Matabeleland.

8/34. No. 927. Some Facts about Tung Oil, by R. H. Finlay, B.A., Dip. For. (Oxon.), District Forest Officer.

8/34. No. 928. Some Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants suitable for the Colony, by J. W. Barnes, Manager, Government Forest Nursery, Salisbury.

12/35. No. 974. Summary of the Annual Report of the Division of Forestry for the year 1934, by E. J. Kelly-Edwards, M.A., Dip. For. (Oxon.), Chief Forest Officer.

Price List of Forest-tree Transplants, Ornamental Trees Shrubs, Hedge Plants, Creepers and Seeds obtainable at the Government Forest Nursery, Salisbury.

HORTICULTURE.

4/27. No. 637. Harvesting, Packing and Marketing of Deciduous and Tropical Fruits, by G. W. Marshall, Horticulturist.

8/27. No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.

2/29. No 725. Investigations into "Collar-Rot" Disease of Citrus, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad)

ENTOMOLOGY AND PLANT PATHOLOGY.

8/29. No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
9/29. No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
9/29. No. 754. "Pinking" of Maize: Report of a Preliminary Investigation, by T. K. Sansom, B.Sc., Plant Breeder.
6/30. No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
6/30. No. 788 A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
A List of Plant Diseases Occurring in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist. Supplement No. 1.
7/30. No. 790. Notes on the Control of Some of the More Important Insect Pests of Citrus in Southern Rhodesia, by W. J. Hall, Ph.D., B.Sc., Entomologist to the British South Africa Company in Southern Rhodesia.
10/30. No. 796. The Army Worm (Laphygma exempta, Wlk.), by Rupert W. Jack, Chief Entomologist.
11/30. No. 798. The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
1/31. No. 804 Locusts in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.
8/31. No. 825. Some Common Diseases of Potatoes in Southern Rhodesia, by J. C. F. Hopkins, B.Sc (Lond.), Plant Pathologist.
3/32. No. 848. Mycological Notes: Seasonal Notes on Tobacco Diseases: 3, Frog Eye; 4, White Mould; by J. C. F. Hopkins, B.Sc. (Lond.).
4/32. No. 850. Pests of Stored Tobacco in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.
6/32. No. 856. A List of Plant Diseases occurring in Southern Rhodesia, Supplement 2, by J. C. F. Hopkins, B.Sc. (Lond.), Government Plant Pathologist.
9/32. No. 861. Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.
11/32. No. 868. Cultural Methods and Tobacco Whitefly in Southern Rhodesia, by M. C. Mossop, M.Sc., Entomologist.
5/33. No. 890. Locusts: Instructions for dealing with Flying Swarms, by the Division of Entomology.
5/33. No. 892. The Tsetse Fly Problem in Southern Rhodesia, by R. W. Jack, Chief Entomologist.
5/33. No. 893. Experiments with Tsetse Fly Traps against Glossina Morsitans in Southern Rhodesia, by R. W. Jack, Chief Entomologist.
6/33. No. 894. Mycological Notes. Seasonal Notes on Tobacco Diseases. 6. An Unusual Type of Frog Eye Spotting, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.
6/33. No. 896. A List of Plant Diseases occuring in Southern Rhodesia. Supplement 3. (New Records for period June, 1932, to May, 1933.) Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.
7/33. No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.

8/33. No. 899. The Black Maize Beetle (Heteronchus Licus Klug), by C. B. Symes.

10/33. No. 904. Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932-1933. Part I.: Control of Locusts, by R. W. Jack, Chief Entomologist. Part II.: Biological Notes on the Red Locust (Nomadacris septemfasciata, Serv.), by M. C. Mossop, A.F.C., M.Sc., Entomologist.

10/33. No. 906. The Locust Invasion of Southern Rhodesia, 1932-33, by R. W. Jack, Chief Entomologist.

2/34. No. 911. Screw Worm. A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Foreword by R. W. Jack, Chief Entomologist.

3/34. No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.

4/34. No. 915. Tsetse Fly and Game, by R. W. Jack, Chief Entomologist.

4/34 No. 917. The Life History of the Screw-worm Fly, by Alexander Cuthbertson, Entomologist.

10/34. No 934 Mycological Notes. Seasonal Notes on Tobacco Diseases. 7, Spraying in Seed-beds and Lands, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

12/34. No 938 The Destruction and Control of Locust Hoppers, by R. W. Jack, Chief Entomologist.

1/35. No. 942. Mycological Notes. Seasonal Notes on Tobacco Diseases. 8, The Mosaic Mystery. 9, Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

4/35. No. 950. The Control of Tsetse Fly in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

4/35. No. 951. Suspected "Streak" Disease of Maize. Notice to Growers, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

6/35. No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

8/35. No. 962. The Report of the Chief Entomologist for Year ending 31st December, 1934, by R. W. Jack, Chief Entomologist.

10/35. No. 969. The Objects and Value of Seed Treatment of Maize against Diplodia, by G. M. Wickens, Ph.D. (Lond.), D.I.C., Assistant Plant Pathologist.

5/36. No. 986 Annual Report of the Division of Entomology for year ending 31st December, 1135, by Rupert W. Jack, Chief Entomologist.

7/36. No. 993. Annual Report of the Senior Plant Pathologist for year ending 31st December, 1935. Part I.: Plant Pathology. Part II.: Tobacco Research, by J. C. S. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist and Officer in Charge of Tobacco Research Station, Trelawney.

POULTRY.

1/29. No. 721. Poultry Keeping in Rhodesia: Pedigree Breeding, by H. G. Wheeldon, Assistant Poultry Expert.

4/29. No. 738. Hints to Breeders: Rearing Young Stock, by A. Little, Poultry Expert.

6/29.	No	740.	Artificial Incubation, Breeding and Rearing of Chicks, by H. G. Wheeldon, Poultry Expert.
11/29	No	761.	Housing and Feeding of Adult Stock, by H. G. Wheeldon, Poultry Expert.
10/30.	No.	795.	The Turkey, by G. H. Cooper, Assistant Poultry Officer.
1/31.	No.	803.	Geese, by G. H. Cooper, Assistant Poultry Officer.
9/31.	No.	827.	The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.
10/32.	No.	865.	Poultry Industry: Care of Young Stock in Hot Weather, by H. G. Wheeldon, Chief Poultry Officer.
11/32.	No.	870.	Trap Nests, by B. G. Gundry, A.I.MechE (combined with No. 875).
12/32.	No.	872	The Poultry Industry: Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.
1/33.	No.	875.	Another Trap Nest, by B. G. Gundry, A.I.Mech.E. (combined with No. 870).
5/33.	No.	884.	The Vitamins in Poultry Feeding, by G H. Cooper, Poultry Officer, Matopo School of Agriculture and Experiment Station.
5/34.	No.	918.	The Moulting of Poultry: The Normal and Pullet Moult, by H. G. Wheeldon, Poultry Officer.
10/34.	No.	933.	Ducks on the Farm (Revised), by H. G. Wheeldon, Poultry Officer.
12/34.	No.	939.	The Use of Galvanised Iron in the Making of Some Appliances for Poultry Keeping, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
12/34.	No.	940.	A Cheap Portable Colony House for Poultry, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
3/34.	No.	947.	Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poultry Officer, Matopo School of Agriculture and Experiment Station.
9/35.	No.	966.	Egg Marketing Bill: Draft of a Bill having for its purpose the more orderly Marketing of Eggs.
11/35.	No.	971.	Feeds for Poultry and How to Use Them, by G. H. Cooper, Assistant Poultry Officer.

The following pamphlets can be obtained from the Poultry Officer upon application:—

Selecting Birds for Laying Tests, by A. Little, Poultry Expert.

Tuberculosis, by A. Little, Poultry Expert.

Prevention of Disease among Poultry, by A. Little, Poultry Expert.

Preparing Birds for Show, by A. Little, Poultry Expert.

The Fowl Tick (Argas persicus), by A. Little, Poultry Expert.

Culling: A Seasonal Operation, by A. Little, Poultry Expert.

Choosing a Male Bird, by A. Little, Poultry Expert.

The Breeding Stock, by A. Little, Poultry Expert.

Diseases of the Digestive System, by A. Little, Poultry Expert

Mating for Improvement and Increased Egg Production, by A. Little, Poultry Expert.

Partial Moult: Broodiness. Selection of Layers of Large Eggs, by A. Little, Poultry Expert.

Exhibiting Eggs at Shows, by A. Little, Poultry Expert.

Condition of Birds on Show, by A. Little, Poultry Expert.

Green Food: The Result of not Supplying Sufficient to Poultry, by A. Little, Poultry Expert.

Good and Bad Hatching Eggs, by A. Little, Poultry Expert.

Grading Fowls, by A. Little, Poultry Expert.

Housing: Three Important Essentials, by A. Little, Poultry Expert.
Advice to Prospective Poultry Farmers, by A. Little, Poultry Expert
Seasonal Hints—August, by A. Little, Poultry Expert.
Successful Chick Rearing, by H. G. Wheeldon, Assistant Poultry Expert.
Hints to Breeders, October, by A. Little, Poultry Expert.
Abnormalities in Eggs, by A. Little, Poultry Expert.
Hints to Breeders. Prepare for the Breeding Season, by A. Little.
Respiratory Diseases, by A. Little, Poultry Expert.
Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.
The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

12/22. No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season, 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.
12/24. No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.
2/25. No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.
6/25. No. 542. Review of the Abnormal Rainfall Season, 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E.
10/28. No. 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc. (Eng.).
10/31. No. 832. The Weather Map and the Short Period Weather Forecast, issued by the Meteorological Office.
2/33. No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.
3/35. No. 948. The Weather, contributed by The Meteorological Office.

AGRICULTURAL BUILDINGS.

9/25. No. 554. Pisé-de-Terre, by P. B. Aird.
4/26. No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.
8/26. No. 605. Flue-curing Tobacco Barns. Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
5/27. No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
11/27. No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16ft., by B. G. Gundry.
10/32. No. 863. Piggeries, by B. G. Gundry, A.I.Mech.E.

5/33.	No	889.	The Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E.; and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.
9/33.	No.	902.	Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E.
12/33.	No.	908.	A Charcoal Safe or Cooler, by B. G. Gundry, A.I.Mech.E., Irrigation Division.
5/34.	No.	922.	Dairy Building in Southern Rhodesia: A Small Farm Dairy, by B. G. Gundry, A.I.Mech.E.
7/34.	No	926.	Dairy Buildings in Southern Rhodesia. Cow Byre--Type II., by B. G. Gundry, A.I.Mech.E.
8/36	No.	996.	The "Gundry" Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.
10/36.	No.	1002	A Simple Farm Gate, contributed by the Division of Forestry.

CHEMISTRY.

12/29.	No.	762.	—The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
4/32.	No.	852.	Mixing of Fertilisers: A Guide to Methods of Calculation, by the Division of Chemistry.
7/32.	No.	858.	The Softening of Waters, by the Division of Chemistry.
1/34.	No.	910.	The Toxicity to Grazing of Grass Sprayed with a Solution of Sodium Arsenite, by A. D. Husband, F.I.C., and J. F. Duguid, M.A., B.Sc.
9/34	No.	930.	Analyses of Rhodesian Foodstuffs, by The Division of Chemistry.
4/35.	No.	949.	Report of the Branch of Chemistry for year ending 31st December, 1934, by A. D. Husband, F.I.C., Chief Chemist.
5/35.	No.	954.	Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts, by J. K. Chorley, F.R.E.S., and R. McChlery, B.A., B.Sc.
4/36.	No.	983.	Annual Report of the Branch of Chemistry for year ending 31st December, 1935, by A. D. Husband, F.I.C., Chief Chemist.

MISCELLANEOUS.

10/24.	No.	518.	Locusts as Food for Stock, by Rupert W. Jack, F.E.S.
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7/28.	No.	702.	Book-keeping on the Farm, by T. J. Needham, Acting Accountant, Agricultural and Veterinary Departments.

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5/31.	No.	820.	The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
6/31.	No	823.	The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
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			Summary of the Game Laws of Southern Rhodesia.
9/34.	No.	931.	Chacoal-Gas as Fuel for Farm Tractors, by W. F. Collins, Assoc.R.S.M., "Riverside," Marandellas.
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5/35.	No.	953.	A Scraper for Levelling Land, by D. E. A. Gutsche, Field Husbandry Officer, Kakamas.
6/35.	No.	958.	A Cheap Levelling Device, by A. W. Laurie, Howick Vale, Concession.
8/35.	No.	961.	A Home-made Ridger. Contributed by Mr. Douglas Aylen, Somerset, Concession.
1/36.	No.	975.	Fertilizers, Farm Foods, Seeds and Pests Remedies Ordinance, 1914.
2/36.	No.	979.	The Prospects of Black Bass in the Inland Waters of Southern Rhodesia. Specially contributed.
6/36.	No.	991.	Silage and Silos.
8/36.	No	995.	Cotton Marketing, by Th. G. Hesse.
8/36.	No.	997.	Reward Wheat: Report on the Baking Properties and Chemical Analyses, by The Rhodesian Milling and Manufacturing Co., Ltd.
8/36.	No	998.	Summary of the Game Laws of Southern Rhodesia.

THE RHODESIA

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications should be addressed to:—The Editor, Department of Agriculture, Salisbury. Correspondence regarding advertisements should be addressed:—The Art Printing Works, Ltd., Box 431, Salisbury.

Rhodesian Chilled Beef in London.—The following is an extract from a letter received from Colonel T. Dunlop-Young, Southern Rhodesia Government Veterinary Advisor in the United Kingdom, and refers to the shipment of chilled beef *ex* "Warwick Castle."

"In the first place, I desire to express gratification at the manner in which the dressing of the carcases has improved. The dressing compares very favourably with any other meat in the Market, and shows distinct evidence of a continued desire on the part of the dressers to improve in their workmanship.

"I understand that Messrs. Kean are reporting that a few of the forequarters have been forequartered off too much on the slant, causing the eye-piece of the forerib not to set square; with this I thoroughly agree. With regard to quality, it is not only my opinion, but the opinion of all the people in the Market, that this consignment of chilled beef was the finest that has ever arrived from Southern Rhodesia, and it was the general comment that no beef entering the country at present has shown so quickly an improvement in the quality and suitability for the retail butcher than Rhodesian beef.

"With regard to the different lots, the salesmen placed the beef with the red and white tapes first, the yellow and green tapes second, yellow and black third, and the no tapes were considered nearly as good as the yellow and black.

"The ordinary run of Imperial beef, taken as a whole, was exceptionally good; a few quarters were rather wasteful and heavy. The condition of the meat in general was very satisfactory, there being an entire absence of moulds, and a presence of brightness, dryness and 'bloom.'

"May I add that if Southern Rhodesia can supply hindquarters of chilled beef similar to those referred to, they will rapidly make a good name for Rhodesian beef in Smithfield Market, and there will be no more difficulty in finding buyers who will be prepared to give, eventually, a price equal to South American beef. The prices obtained, namely, hindquarters, 3/6 to 4/-, and forequarters 1/10 to 2/- per stone, compare favourably with the Argentine on the same week, which made 3/8 to 4/2 for hindquarters and 1/9 to 2/1 for forequarters.

"In conclusion, I desire again to congratulate most heartily all concerned with the great progress that has been made in the production of Rhodesian beef. This includes breeders, feeders, butchers, graders, transporters and the officers of the Ministry of Agriculture.

"'Enfin' send constant supplies of the same kind."

Munga and other Grass-type Crops as Green-Manure.—Owing, it is believed, to the rise in the price of Sunnhemp seed, it is understood that a number of farmers are intending to employ grass-type crops such as Munga, Amber Cane and Kaffir Corn, as green-manure instead of the usual Sunnhemp this season, and it is considered that a word of warning regarding the possible dangers in the practice may be timely.

The danger of serious nitrogen-robbery from the soil by ploughing under such crops when they have matured beyond two months from germination has been fully explained in an article on Witchweed published in the November, 1935, issue of this Journal (reprinted as Bulletin No. 972).

There is another possible cause of loss in green-manuring with grass crops, which many farmers do not perhaps realise, and it is this: if a grass type crop is sown early in the season (before January) and ploughed under in time to avoid nitrogen-robbery from the soil (within eight weeks from germination) then there is a likelihood that the crop will rot down too rapidly, in that the insoluble organic nitrogen will be converted into the soluble nitrate form too soon and be lost from the soil through leaching or washing out by the subsequent rains, to the detriment of the crops the following year.

It will be seen, therefore, that the use of grass-crops for green-manuring is attended with certain risks, which are justifiable when they are employed as trap-crops for Witchweed control, but, when used solely for green-manures, the extra risk may be considered by some not to be worth the saving in the cost of seed. It may be pointed out that the cost of seeding with Munga (7 acres per bag at 9/-) is about 1/4 per acre, whereas in the case of Somerset Sunnhemp (10 acres per bag at 27/6) it is 2/9 per acre.

The farmer has to decide, in fact, whether the extra risks of green-manuring with grass-crops are justified by the saving of £7 1s. 8d. per 100 acres of land under green-manure. The answer to this question will obviously depend to a large extent on whether a farmer has a sufficient number of ploughs and oxen, or tractors, to enable him to plough under the green crop rapidly enough to reduce the risk of nitrogen-robbery taking place.

The other risk of loss of nitrogen by leaching may, of course, be largely avoided by sowing after Christmas, but this involves the extra cost of keeping the ground free from weeds until sowing time. If the land to be green-manured is infested with Witchweed, the position is very different and can be advised strongly to use Amber Cane and Munga as green-manure crops, but he should sow about mid-January.

The Rothamsted Report for 1935.—The purpose of the investigations of Rothamsted Experimental Station is to develop a science of agriculture that farmers, manufacturers, merchants, expert advisors, lecturers and others can use in their daily work.

The range of the investigations includes the growth and composition of crops, the properties of soils, of fertilisers and manures, the conditions in which each can be used to the best advantage, soil management, plant diseases, insect pests, bees and other subjects.

The publication of the 1935 report places the results of the work carried out in the various laboratories and on the farm in such a form that all who are connected with the agriculture industry will find much to interest them.

The section dealing with Crop Production—Grassland Experiments, Arable Crops—gives useful information to the farmer. Under these headings will be found not only the results of experiments on the Rothamsted and Woburn farms, but on farms situated in many parts of England. These outside experiments form an important part of the Rothamsted programme and cover a wide field of investigation, much attention being given to sugar beet and potatoes and also to the use of poultry manure.

The importance of vegetable crops has considerably increased during recent years, and growers will find the results of various experiments under the section "Experiments on Vegetable Crops."

In addition to fertiliser trials, problems in general husbandry are studied. Further progress has been made in the comparison of electric motors with oil and petrol engines

as sources of power for barn operations. The results are expressed on the number of units of electricity, that are equivalent to one gallon of fuel for various classes of work, under given conditions. In this form they can be used by a farmer who wishes to know what the relative costs would be on his own farm.

The Report also includes special summaries of the investigations made in certain Departments: the review of thirty years' work in the Botanical Department should prove of much interest to agricultural botanists; the account of the Bee-keeping Section deals with the practical and scientific aspects of apiculture; and the review of the Biochemical Section discusses work on the composition of crops with special reference to their quality.

[Obtainable from the Secretary, Rothamsted Experiment Station, Harpenden, Herts., price 2/6.]

Importation of Purebred Friesland Bulls.—The Chief Animal Husbandry Officer and the Senior Animal Husbandry Officer of the Matopo School of Agriculture attended Roderick's sale of purebred Friesland cattle at Bloemfontein on the 22nd and 23rd September for the purpose of purchasing a number of bulls for different farmers under the Livestock Improvement Scheme.

Eighteen specially selected bulls were obtained, of which 14 were for Mashonaland and four for Matabeleland farmers. The bulls are out of the best blood lines in the Union and cost from £40 to £105 each.

In the selection particular care was taken to get animals which would improve the herds they were intended for. At times it was necessary to sacrifice minor fancy points for utility points such as breeding, constitution and milk and butterfat records.

All the bulls were sent direct to the Veterinary Laboratory for inoculation against Redwater and Gallsickness and despatched from there to their different owners during the beginning of December.

It is the opinion of experienced stockmen that these Friesland bulls are, as a lot, the best ever introduced into the Colony, and it is hoped they will effect considerable improvement in the different herds.

Loans for Green Manuring and Purchase of Artificial Fertilisers.—The Minister of Finance has approved of the Land and Agricultural Bank of Southern Rhodesia making loans to farmers for green manuring and purchase of artificial fertilisers under the following conditions, as recommended by the Soil Conservation Advisory Cuncil.

(*a*) The loans are for the purpose of meeting the cost of the green manuring and fertilising of lands which have been badly eroded and subsequently suitably protected by contour ridges but which are judged to be incapable of producing a cash crop without this treatment;

(*b*) Loans will require in the first instance to be recommended by an officer or officers of the Department of Agriculture, or by the local sub-committee, or by both, and subsequently will be considered and reported on by the Finance Sub-Committee of the Soil Conservation Council;

(*c*) The loans are to be made on the best security available to the Bank, subject to the applicant being satisfactorily reported on;

(*d*) i. Interest will be charged on these loans at 5 per cent. per annum, payable half-yearly in arrear, the first payment being due six months after date of issue of the loan.

ii. Capital will require to be repaid in six half-yearly instalments, the first of which will fall due 3½ years after date of issue of the loan.

(*e*) The loan which may be approved for any individual farm in any one year will be limited to a maximum of £100.

All applications for these loans should be submitted in the first instance to the Secretary, Department of Agriculture and Lands on the prescribed form of application which may be obtained from the Land and Agricultural Bank of Southern Rhodesia, but those applying are recommended to obtain from their local Soil Conservation Committee, and attach to the application, a brief report certifying that the lands to be treated are suitably protected by soil conservation works, and are in need of either fertilising or green manuring, or both. All applications will subsequently be considered by the Finance Sub-Committee of the Soil Conservation Council and, if recommended, will then be passed to the Manager of the Land Bank, who will obtain the necessary security and arrange for the disbursement and eventual collection of the loan.

EUROPEANS ACTIVELY ENGAGED in FARMING 1931 AND 1935, IN SOUTHERN RHODESIA.

(Compiled from information supplied on annual statistical returns received from farmers).

	1931.	1935.
Owners—		
Males	2,606	2,523
Females	195	210
Managers—		
Males	691	693
Females	111	87
Learners—		
Males	206	162
Females	30	24
Others—		
Males	624	524
Females	78	82
Total—		
Males	4,127	3,902
Females	414	403
	4,541	4,305

Imperial Economic Committee: Plantation Crops.—The title "Plantation Crops" recalls the time when sugar, tea, cocoa, spices, tobacco and rubber were produced mainly or entirely by the "planters" on their "plantations" overseas. To-day only a few are still plantation crops in the old sense. The traditional title has, however, been retained by the Imperial Economic Committee for a review just issued (price 2s. 6d. or 2s. 8d. post free), which summarises the figures of production and trade relating to these crops.

The producing countries are mainly tropical or sub-tropical, and their output of these commodities (with certain important exceptions) is primarily destined for overseas markets. The extent to which the export trade of many countries depends on one or two or these crops is brought out by this publication. For example, during the period 1930-34, sugar constituted almost the whole of the exports, by value, of Mauritius, while tea, coffee and cocoa accounted for two-thirds of the exports of Ceylon, Brazil and the Gold Coast respectively.

The leading importers are the United States and the United Kingdom. The former imports larger quantities of sugar, coffee, cocoa and rubber than any other country, while the United Kingdom leads in tea and tobacco and is second only to the United States in sugar and rubber. Statistics for the period 1930-35 show that the United Kingdom relies to an increasing extent on Empire sources for its supplies of sugar, tea, coffee, cocoa and tobacco.

The Empire produces over a half of the world's cocoa and rubber and a substantial proportion of all the other commodities surveyed, with the exception of coffee. As a whole, however, the Empire has an export surplus only in cocoa and in rubber.

The world production of *cane sugar* fell from 1932 to 1935, chiefly because Javenese production was heavily curtailed during that period in accordance with the Chadbourne Plan and because markets were lost in Asia. India, one of those markets, has doubled its output in six years and is now the largest producer in the world. The production of *beet sugar* (chiefly in the United States and in Europe) has

increased steadily since 1932. World sugar stocks are estimated to have fallen by some 40 per cent. since 1931, but prices in the United Kingdom are still below the 1930 level.

World trade in *tea* has diminished in volume. Since 1933 exports from India, Ceylon and the Netherland East Indies, which are the most important exporting countries, have been regulated by an international agreement. Here again, though prices have risen above the 1932 trough, they are still much below those of previous years. The consumption of tea in the United Kingdom still seems to be rising.

Brazil, producing 60 to 70 per cent. of the world *coffee* supplies, has reduced stocks since 1930 by destroying a quantity nearly equal to two years' crops. This drastic policy has not prevented a continuous fall in values; the average price in 1935 was less than 60 per cent. of that of 1929. Empire output, though relatively small, is increasing steadily, and the United Kingdom and the Dominions are taking an increasing proportion of their supplies from Empire growers.

The exports of *cocoa*, particularly from West Africa and Brazil, continue to expand in response to the increasing demands of the American and European markets. Since 1933 prices have been on the up-grade.

The United States, for long the largest producer of *tobacco*, now produces less than India and China, but remains the chief exporter.

Exports of *rubber* have been regulated since July, 1934, by an international agreement including all the important producing countries and permitting the gradual expansion of exports to meet the anticipated increase in demand. The United Kingdom price has risen since 1932 and is now higher than it has been since 1930.

SALES,

Agricultural Experiment Station, Salisbury.

Spineless Cactus Slabs (blades) Algerian and Moscatel varieties, per 100 Slabs 5/- delivered at the Salisbury Experiment Station, or 7/6 delivered free by rail to any station or siding in Southern Rhodesia. For amounts of 500 slabs or more a reduction of 2/6 per 100 will be made.

Kudzu Vine Crowns, per 100 Crowns 15/- delivered at Salisbury Experiment Station, or 25 Crowns 7/6; 50 Crowns 15/- and 100 Crowns, 22/6, delivered free by rail to any station or siding in Southern Rhodesia. Delivery during January for dry land. Owing to pressure of other operations it is not possible to deliver Kudzu Crowns and Cactus Slabs during December.

Woolly Finger Grass, 10/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia; supplies limited. Available in January and February.

Swamp Couch Grass, 5/- per bag of roots, delivered free by rail to any siding or station in Southern Rhodesia. Available in January and February.

Sweet Potato Cuttings, 6/- per bag, delivered free by rail to any siding or station in Southern Rhodesia. The following varieties will be available in January. Calabash Leaf, Early Butter, Linslade, Red Nancemond, Yellow Jersey.

The prices quoted do not include charges for road motor transport. Cheques should be made payable to the Department of Agriculture, *and preliminary enquiries and subsequent orders* should be addressed to the Agriculturist, Department of Agriculture, Salisbury. (Dec.-Jan.)

Successful Control of Witchweed.

By Rhodesian Farmers.

At a meeting of the Mazoe (Concession) Farmers' Association held a few months ago certain members of that Association made statements to the effect that the methods of control of witchweed advocated by this Department had not proved effective. Since it was well known that many farmers (some of them members of this Association) were efficiently controlling the parasite on the lines advised by this Department it was decided to ask them to give their experiences for the benefit of their fellow-farmers. Some twenty replies have so far been received, and since they are of great interest it is the intention to publish some of them in full each month in this Journal. All the letters so far received show that not one of the writers has any doubt that this very serious menace to the maize industry can be economically brought under control by the methods this Department has been advocating for many years. All the writers are farmers of standing and experience, and it is hoped that their courageous and energetic fight against witchweed will serve as an example to those of their fellow-farmers who are allowing a policy of pessimism to gain the upper hand and sap their energy.

Some of these letters give clear proof that by proper hand cultivation alone severe infestations of witchweed can been brought under control efficiently at a cost of about 1s. to 1s. 6d. per acre for the first two years, and thereafter rapidly falling to 6d. and 2d. per acre. Such costs for essential work cannot be considered excessive.

If a trap crop replaces the green manure crop each year, as is strongly advised, the costs are very much less and the period required to bring about full control very greatly shortened.

Two full trap crops ploughed under in one season in place of green manuring, combined with hand cultivation, will reduce the total costs and increase the rapidity of control still further.

Those farmers who are nervous of witchweed seeding in the first of two traps owing to wet weather preventing ploughing, can secure safety from this by sowing munga (at 30 to 35 lbs. per acre) instead of the normal trap crops. It must be borne in mind, however, that munga is only about half as efficient as amber cane or Sudan grass in germinating witchweed. The first trap of munga can then be followed by amber cane and Sudan grass, which will normally be ready for ploughing under in March.

Remember that to obtain good green-manuring results from trap crops they must be ploughed under within eight weeks from germination. If left to mature longer nitrogen-robbery of the soil will take place, and the yield of the following maize crop will be reduced.

REPORT No. 1.

"This is just briefly how I dealt with and controlled witchweed on this farm. It was discovered during 1926 that this weed was doing damage to the maize, and although I started to take it out it was done half-heartedly, and by 1929 the place was so badly infested that over an area of 800 acres under maize I completely lost about 80 acres, and my average loss was about 2 to 3 bags per acre over the 800 acres during the 1929-30 season. During the 1929-30 season a four-years course rotation was started on this farm, so that since then no one land has grown more than five maize crops over the seven years under review.

Now for my methods of dealing with witchweed since the 1929-30 season. As soon as cultivating and hand weeding are done, which is usually the first week in February, witchweed collecting starts, with all available labour. Each 'boy' gets a fertiliser sack which is turned half inside out and forms a knapsack and all witchweed plants that have flowers are hand

picked and carried off the field and put into a shallow pit dug for that purpose. At the end of the season 6 inches to 7 inches of earth are put over the witchweed so collected to prevent any seed from blowing out. These pits can be dug at the end of the fields at handy spots. All witchweed that has not started to flower is cut off with hoes just below ground level. It is always best to let the boys hand pick for, say, 50 yards, put their sacks down and and then get their badzas, and follow up to where they have left their sacks.

Owing to the depression and shortage of labour I could not manage to go through my lands more than once a month, that is, three times in a season.

When I first started during 1929-30 season from 800 acres I filled 75 woolpacks with witchweed, equal to 780 grain bags. (I measured the witchweed in woolpacks for my own information). The following season I only filled 45 woolpacks, and this season I don't think I filled more than 4 packs over an area of 1,100 acres under maize. During the 1929-30 season 'boys' wages amounted to £55 7s. 9d. to collect witchweed on 800 acres, and this season it amounted to £11 3s. 3d. over *1,100* acres under maize, or about 2½d. per acre.

During 1930-31 I took over some extra lands of which one field of 100 acres was very badly infested with witchweed. This is how this 100 acre field was treated:—1930-31 planted with sunflowers and beans, 1931-32 planted with maize—*yield 3 bags per acre;* 1932-33 two trap crops of Kaffir corn; 1933-34 maize, 7 bags to the acre; 1934-35 one trap of Kaffir corn which grew very badly owing to excessive rains; 1935-36 maize yield 9 bags per acre. This field had a severe set-back with drought and damage by locusts, and if it had not been for these set-backs I am sure it would have yielded 10 or more bags per acre.

Most of my lands are storm drained, which is most essential for the controlling of witchweed. *For very badly infested fields, trap cropping is the best and the cheapest method of controlling and getting rid of this pest,* at the same

time it is hopeless and practically useless to trap crop if the fertility of the soil is very poor, and my advice is to first build up the fertility of the soil so that you can grow a robust plant with a good root system. Trap cropping will do the rest provided it is thickly planted early in the season and ploughed under at the correct time (within two months from germination)."

Remember this:—Hand weeding needs 100 per cent. supervision.

(Signed) F. C. du Plooy,
Section Manager, Riversdale Estate, Marodzi.

Editorial Note.—It should perhaps be emphasised that by employing Mr. du Plooy's system of hand pulling the witchweed in flower and hoeing the rest, the safe interval between cultivations can be considerably increased, but without the "100 per cent. supervision" Mr. du Plooy specifies it is dangerous for the average farmer. The safest system for the latter is to hoe the weed each time it *commences* to flower, that is every 18 days at the beginning of the season, to every 10 days at the end.

REPORT No. 2.

"Yours of the 28/7/36 to hand. Re trap cropping as a means of control of witchweed. *Amber cane* is the only form of trap crop I have used so far and the method I used in handling this crop in my first try out, as explained in a report I sent you on the 9th March, 1934, *has proved so successful that I intend to use it in my crop rotation until I have been over the whole of my lands.* For your information I append results on the Block *No. 1* as previously reported to you, as compared with a similar Block *No. 2* green cropped with velvet beans in the same year (1933-34).

Both these blocks of 70 acres each were badly infested with witchweed before being green cropped and were again planted to maize in the years 1934-35 and 1935-36:—

Field *No. 1* (after trap crop) has cost £1 per year in labour on witchweed and is practically free from it.

Field *No. 2* (after velvet beans) has cost £12 per year in labour on witchweed and is still badly infested. As regards yield Field *No. 2* looked better the first year but did not yield as well as it looked like doing owing to the toll taken by witchweed, and on the two years the yield has been practically the same on both fields with the balance in the favour of No. 1 as regards labour.

These fields will both be under maize next season and on the tired soil I expect to find field No. 2 drop considerably in yield, and rise in cost of cleaning unless I let the witchweed rip and depend on the following trap crop to clean it up. The cultivation costs on both fields were practically the same, except for the dealing with witchweed.

1. *Storm Drains and Contour Ridges* I am certain help very much to keep witchweed from spreading, as it was very noticeable on this farm before storm drains were put in that the first lands infested were those next the open veldt where storm water was able to carry seed on to the lands.

2. *Hand cultivation* helps to keep the witchweed from seeding, but it is difficult on big acreages to go over the land often enough to keep up with the growth of the pest, especially towards the end of the growing season when hay making and other side crops require a lot of labour.

The custom of planting pumpkins amongst the mealies is, I find, another big hindrance to effective eradication of witchweed, as many of the weeds are hidden under the leaves and escape the hoes. *I am, in view of the above findings, firmly convinced that trap cropping is the only effective way, and also the least expensive, of eradicating witchweed.*"

Editorial Note.—It is the excellent practice of the writer of the above, one of the best farmers in the maize belt, to sow Kaffir beans thickly immediately his trap crop has been ploughed under. This assists the green manuring effect of the

trap, and if the ploughing under of the latter is unduly delayed it tends to correct any nitrogen-robbery of the soil which may take place. A sunnhemp crop can profitably be grown for hay after a trap crop, and it is thought that this would be still more profitable.

REPORT No. 3.

Mr. Laurie, of Howick Vale, the writer of the following report, makes it his normal practice now to take a sunnhemp hay crop following his trap crop.

Re WITCHWEED CONTROL.

1. *Storm Drains.*—These are essential and should be as close as possible to the land they protect. In one field I had a strip of bush about 50 yards wide between the drain and the land, and it was most apparent that witchweed seed was being washed from this "bush" on to the field. Dividing the field by contour ridges is also of assistance.

2. *Hand Cultivation.*—Though this is undoubtedly a most valuable method of control where infestation is light, it is extremely expensive where witchweed is really bad, and personally I have had to give up relying on it as, when most required for this work, I need all my labour and attention for tobacco curing.

3. *Trap Cropping.*—*I think this is the method which holds out the greatest hopes of success.* Even if they do not eradicate the weed completely, used regularly in rotations they should keep it in most effective control and enable one perhaps to put the finishing touches by hand labour.

Further, *the actual trap crop can be made to pay its way* by using it for *hay or silage,* and if cut early in the season a second crop of sunnhemp planted immediately can be mown when in green pod leaving the soil the richer by the nitrogen in the roots.

I regret I cannot give much in the way of costings, etc., as in the past most of my trap cropping has been on a small scale. But the history of one field on this farm might be of interest.

Year.	Field of 18 acres.
1929-30	Virgin soil ploughed during rains.
1930-31	Planted to maize. Rainfall 40.9 inches. Yield 18 bags per acre.
1931	Planted to maize. Rainfall 40.22 inches. Yield 12 bags per acre. Witchweed beginning to show in field.
1932	Kraal manured. Planted maize. Rain 35.57 inches. Yield 8 bags. Witchweed bad throughout field.
1933	Contour ridged. Planted and ploughed in two heavy crops of Amber cane.
1934	Planted maize. Rain 39 inches by February 7. 5 inches in late March. Suffered badly in droughty spell. Yielded 10 bags to an acre.
1935	Planted maize. Rain 29½ inches. Estimated yield 12 bags per acre.

The two crops of amber cane, though they did not exterminate the witchweed, or perhaps even reduce it by 90 per cent., certainly reduced it very considerably indeed, and enabled maize to be grown when otherwise it would have been impossible.

Attempting to cure the effects of witchweed by ploughing in sunnhemp I found almost useless. There are fields here which are sufficiently fertile to give 4 bags per acre of beans and 15 bags per acre of sunflowers or monkey nuts which will not yield 3 bags per acre of maize, entirely on account of witchweed.

Kaffir corn I found unreliable; some strains hardly germinated any witchweed at all. Munga I have not tried on a large scale, though it seems promising.

Amber cane is the best trap crop tried so far. It is easy to plant, to plough in, to reap the seed and mow, and is a good germinator."

(Signed) A. W. Laurie,
Howick Vale, Concession.

Bee Keeping in Rhodesia.

By T. W. SAVORY, Monze, Northern Rhodesia.

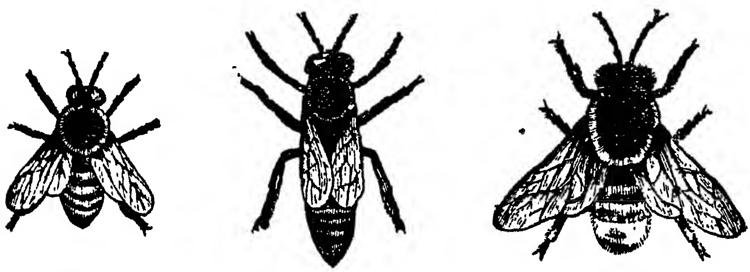
PART I.

Although this series of articles is written to apply mainly to Rhodesian conditions, it is hoped that they will be of interest to many from the Cape to the Congo. An endeavour will be made to bring the subject matter up to date, as in bee keeping in common with other industries improvements in methods have been made.

The whole southern part of Africa from the Cape to the Congo is a vast territory with a wonderful variety of climate, rainfall and indigenous flora which offers very different conditions from those found in the British Isles, Canada, North America and other important bee countries. This is specially noticed in regard to winter management, as in the colder countries special treatment is needed. The apiarist can be satisfied that he is travelling in good company. The references to bee keeping and to the uses of honey for food or barter go back to the very earliest times. Bee keeping is practised in all parts of the world. In America, which is the world's largest honey producer, a recent census gave over five million pounds of weight of honey. Up to the present South Africa has paid but little attention to bee keeping, considering its wonderful possibilities in this direction. This is strange when we consider its wonderful flora and the fact that no honey is allowed to be imported because of the danger of introducing the dreaded disease of bees known as foul brood.

Three strains of the African honey bee, *Apis mellifica var. Adansoni*, appear to exist in the wild state. One of these makes its hive in holes in trees, another in the ground and the third in rocks or krantzes. The bee keeper, however, is advised to make use for hive purposes of only the first, which is found in holes in trees. The variety found in holes in the ground is not worth hiving, as it is smaller and produces little honey. The rock or krantz variety should never be hived. It

is dangerous, and one such colony in an apiary can cause much trouble and often upsets the other bees. The tree variety which is recommended compares favourably with any hive bee in the world as a good worker, but even in this there are good and bad strains, and the bee keeper must make a study of their habits and eliminate any strains which are not found to be satisfactory. A few years ago the Union Department of Agriculture, at Pretoria, imported a number of Italian queens. About a dozen of these were purchased by the writer and tried at Monze. The results, however, were most unsatisfactory. The honey production dropped at once and the bees would not work satisfactorily. After trying them out most carefully for four years every queen was destroyed and each colony was re-queened with the native strain.



Worker. Queen. Drone.

Fig. 1.—All about twice natural size.

Although it is recognised that this is not a subject upon which one should dogmatise, it is considered that Rhodesia is not sufficiently advanced in bee keeping to make experiments which take several years to complete, and it is considered that the beginner should certainly start by using native queen bees. As is known, the life history of the bee is simple. A hive contains three kinds of bees, the queen which is the mother of the colony; the drone which is the male; and the worker, which is an undeveloped female. The success of the hive depends to a large extent upon the queen. She may live from two to five years but many bee keepers prefer to re-queen every two years, as this time is considered to be the only useful period. Experience differs, however, and many queens have been found to be at their best in the third year. To be successful a hive must be vigorous and when it is considered that during the summer time the life of a

worker does not average much more than six weeks the number of eggs laid by the queen must be very large to maintain a strong colony. It has been ascertained that she may lay 2,000 eggs a day for weeks at a time, and it will therefore be realised that the queen is one of the most remarkable of insects, even if her active life does not last much more than two years.

As the name indicates the workers do everything connected with the activities of the hive. Not only do they make the wax, using 12 to 15 pounds of honey to produce 1 lb. of wax, but they make the cells for the brood, honey and foodstuffs, but they also attend the young, clean the hive and collect all the stores, whether nectar, pollen, propolis or water. The drones are not even capable of gathering their own food but feed upon the honey made by the workers, and it is not surprising that in the colder countries at least they are driven from the hive by the workers in winter and die of starvation.

The beginner should certainly supply himself with certain literature which is necessary for reference or general information. The standard work called "The A.B.C. and X.Y.Z. of Bee Keeping,' by Root, will be found to be of the utmost value as a reference book. "Bee Keeping in South Africa," by T. A. Attridge, is also very useful, and the Journal of the Beekeepers Association of Johannesburg would keep one in touch with local interests in bee keeping.

Although bee keeping has not yet made much progress in Rhodesia, there is no reason why it should not provide a useful sideline on most farms. Not only will it provide an additional source of income, but in addition a new interest. Provided the small apiary is situated some distance from the house and is properly fenced to exclude stock of all kinds the bees are not likely to cause any trouble. Everything round the apiary should be orderly, and if the bees are handled properly and with ordinary care they should not be any more dangerous on the farm than any other stock.

A Rhodesian Hive with all Parts Interchangeable.—Of the making of hives as with books, there is no end. Some bee keepers have one fancy some have another, but for all general purposes in a country like Rhodesia where there are not the winter difficulties to contend with, the one known as the

Langstroth ten frame hive is the best of all and should rank as the standard hive of the country. As a matter of fact, it is the hive *par excellence* throughout the world. The English and the American hives are the two generally known, and of these the American or Langstroth is mostly used. It was invented as long ago as 1851, by the Rev. L. Langstroth, of Philadelphia, a life-long student of the honey bee, and often called the father of modern bee keeping. It was he who first introduced the movable frame, by means of which the honey industry made a real start as a business concern. He died in 1895, one of the greatest of beemen the world has ever known. There are, of course, many other makes, each claiming special advantages, but accepting the Langstroth as a recognised standard practically throughout the world we can get ahead with the Rhodesia model.

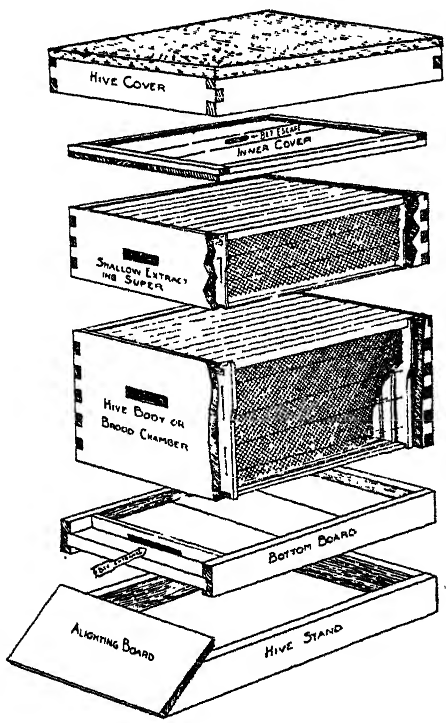


Fig. 2.—A typiral modern hive (after Root).

A hive consists of several portions which are well shown in the illustration. It will be seen that there is the bottom board on which the brood chamber rests. Next comes the brood chamber itself, in which the queen is kept, and all the breeding of young bees is carried on. Then there is what is known as a super, used to place the shallow frames in which is stored the honey for extraction and then the hive cover. The bee escape there shown is a board made to the same shape as the super, with what is known as a bee-escape inserted in about the middle. This is put between the super and brood chamber when the time has come to rob the bees. The escape itself is a small contrivance by which the bees can go back to the chamber below but cannot return, thus leaving the super of honey quite empty, and it is thus an easy job to take it off for extracting the honey. There is also —but not shown on the plan—another board the same size as the escape board that is called a queen excluder. This has a set of wires throughout that allow all bees to pass through to the upper chamber from the brood one, except the queen herself. This is placed over the top of the brood chamber as soon as it is found necessary to put a super on for the storage of honey. A sloping roof cover to keep off the sun may be found necessary as the heat may be so great that the combs may melt and cause much trouble. A second super for storing what are called comb sections should be added. This holds about 24 to 30 sections each weighing about 1 lb. when full.

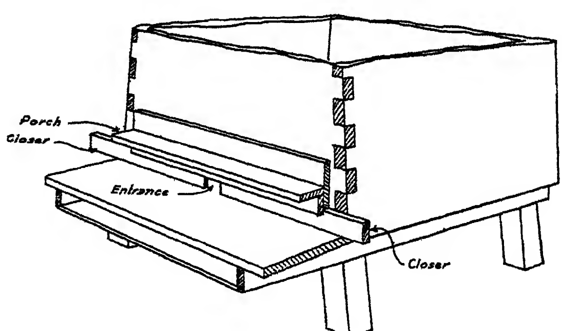


Fig 3
Showing entrance to hive with porch and closers

The ordinary hive of Langstroth pattern can be landed in Rhodesia complete with double super for about £4, with frames, queen excluder, etc., surely not an extravagant figure on which to start a side line for profit. At the same time it should be mentioned that there are several sundries that must be purchased before the venture is on a proper footing. Home-made hives are as a rule condemned in treatises on bee-keeping, but why so it is difficult to understand, for they are easily made on the average farm. The writer has from the first made all his own except one purchased later for comparison, and has had during the course of fifteen years up to thirty-five hives all home-made, all of which have been in constant use and are to-day almost as good as the day they were made. With a little paint now and again, such hives will last, with ordinary care, probably as long as the owner.

(*To be continued.*)

Tobacco Research on the Trelawney Station

1935-1936 SEASON.

The reports of the Technical Officers engaged in Research work at the Trelawney Station for the past season have been considered by the Tobacco Research Board and it has been decided that the following information, from these reports, may be of general interest to tobacco growers.

The following points are taken from the report of Mr. H. F. Ellis, Acting Officer in Charge, who is responsible for all investigations concerning cultural methods, fertilising and curing.

1. **Seed beds.**—A number of experimental seed beds were laid down to test among other things, the rate of thinning, rate of sowing and rate of fertiliser application. General observations on rate and type of growth as far as fertiliser was concerned, indicated that considering density, early maturing and development of a good root system the best application consisted of 1 lb. of 20—7—10 fertiliser for every five yards of seed bed, the width of the seed bed being $3\frac{1}{2}$ feet. The rate of thinning trials yielded very little information, though it appeared that to obtain a large number of suitable plants per bed, the seedlings should be spaced 2 to $2\frac{1}{2}$ inches apart. The rate of seeding experiments indicated that in order to obtain good density, and to reduce the necessity of thinning out considerably, a rate of sowing slightly below 1 teaspoon per thirty square yards was most suitable; 4-5ths of a teaspoon per 30 square yards with seed of a high germination gave the best results. Best results were uniformly obtained where the seed bed was left rather rough. When broken down to a very fine tilth it was found that the seed tended to wash together, and the distribution of the plants in the bed was irregular.

2. **Spacing Trials.**—A very complete series of experiments planned to provide reliable information in regard to the spacing of tobacco in the field has now been carried on for three seasons, and was this last year varied to include both the distance between the rows and the distance in the row. It is too early yet to draw any final conclusions from these experiments, but a few of the general observations made by Mr. Ellis may be of interest.

For any given spacing between the rows, the percentage of brights tends to be lowered as the spacing between the plants in the row is decreased, though this effect is not particularly noticeable until the spacing between the rows attains the distance of 3 ft. 6 in. Similarly for any spacing in the row, it can be seen that the percentage of bright leaf tends to decrease, and that of the medium leaf to increase as the spacing between the rows is widened. So long as the distance apart of the rows remains constant the percentage of short leaf decreases rapidly as the spacing of plants in the row is increased. The percentage of bright and of medium tobacco produced is influenced both by the width between rows and the distance apart of the plants in the row, the effect of the latter factor is usually greater than that of the former. The width between the rows has very little effect on the amount of short leaf produced, in each case the dominating influence determining this percentage is the distance that the plants are set in the row.

Samples of tobacco from each of the experimental treatments have been kept, with a view to subsequent analysis and smoking tests. It has been demonstrated elsewhere that closeness of spacing has an influence on the nicotine content of tobacco, a fact which might be worth investigating in relation to the smoking quality of the tobacco.

3. **Topping Trials.**—An elaborate series of topping trials was laid down with a view to ascertaining the optimum time and height of topping. In conjunction with these two different levels of fertiliser were applied, one level at 200 lbs. and the other at 400 lbs. per acre of 20—7—10 fertiliser, to observe the effects of similar topping treatments on tobacco treated

with low and high dressings of fertiliser. The plots were so arranged as to include topping at three different stages and at two different heights. The stages selected were:—

(*a*) early bud stage, *i.e.*, when the bud shows well above the leaves,

(*b*) early flower stage, *i.e.*, when approximately three flowers have opened,

(*c*) full flower stage, *i.e.*, when the plant is in full flower and has already set two or three seed pods.

Although the results of these experiments have been fully discussed by Mr. Ellis, it is obvious that further work in this direction is necessary before all the characters concerned can be definitely determined. The following points, however, seem to be definitely established:—

(*a*) On the type of soil used in these experiments there was no increase in value or quality in the plots receiving 400 lbs. fertiliser and the expense of the additional 200 lbs. of fertiliser per acre over the ordinary standard dressing was certainly not justified on this second year land;

(*b*) The height of topping had little effect on the date of maturity, but the stages at which the plants were topped did have a very definite effect. Plants topped in the early bud stage produced tobacco of superior quality and also gave better yield than any of the others. Topping when in full flower gave consistently poorer results than either of the others.

4. **Time of Application of Fertiliser.**—The experiment was laid down with a view to determining whether best results were obtained by applying the fertiliser to tobacco in one or two doses. All plots received a standard dressing of 200 lbs. per acre of 20—7—10 and were planted on second year land. The treatments tested were as follows:—

(*a*) all fertiliser applied before planting,
(*b*) half before planting and half four weeks later,
(*c*) all fertiliser applied four weeks later.

From the results of last season's work it is obvious that this experiment must be continued for a number of seasons so that the seasonal effects may be averaged. The results of the past season would indicate that under the climatic conditions then experienced the yield of tobacco was considerably increased when the fertiliser was applied later and that when the fertiliser was applied half before and half after planting there was a definite increase in value over the plots in which all the fertiliser was applied before planting.

It should be emphasised that while the results show certain trends, the experiment is not statistically significant, and the results may well be due solely to chance. It is not, therefore, possible to make any definite statement that one particular treatment may generally be expected to give better results than any other.

The results of the following series of experiments are not yet sufficiently conclusive to warrant their publication:—

(*a*) Method of application of fertiliser;
(*b*) Phosphatic fertiliser trials;
(*c*) Method of planting;
(*d*) Rotation trials.

5. **Nematode Experiments.**—During the past season a very important series of experiments was started at Trelawney by Mr. J. C. Collins. A survey was made of two badly infested pieces of land within a few miles of the Experiment Station and one of them has now been selected for future investigations. This has been most carefully plotted, and from the tobacco grown on it last season a plan has been prepared showing the percentage of plants infested with nematode. The total area was sub-divided into a hundred and fifty small plots and the percentage of infestation varied from 0 to 100 per cent. This investigation includes the determination of native host plants, the examination of seed bed water supplies, the life history of the nematode and methods of control.

Every precaution is being taken to avoid the infestation of the tobacco lands at Trelawney and special facilities are being provided to enable these experiments to be conducted without danger to the Station.

6. **Tobacco Breeding Work.**—A very valuable start has been made on a comprehensive programme of tobacco breeding by Dr. A. A. Moffett. As this was the first season that Dr. Moffett has spent on this work a considerable amount of time was devoted to evolving suitable methods of making selections, and of recording the characters selected. The technique of selection is of particular importance in tobacco where it has been shown that a large number of genetical factors are concerned in the expression of any one character with the result that the inheritance is never clear cut but always of a graded type. It is of fundamental importance that once the line of selection has been decided upon, it should be rigorously adhered to from year to year. If this is not done, owing to the number of genetical factors involved the plant is maintained in a state of flux and no great advance in breeding can be made. It was necessary, therefore, to devise some method by which the morphological characters of the plant could be recorded accurately and the records used as a basis for the next year's selections. Furthermore, since the final criteria for selection in tobacco are the yield and quality of the cured leaf, it is of great importance that some idea of the curing qualities of the selected plants be obtained. These points were borne in mind in making all selections and records.

Measurements by themselves proved to be of little use as the differences within varieties is almost as great as differences between varieties. In one outstanding case two plants completely different in appearance when measured appeared almost identical on paper. Photographs were, therefore, combined with measurements. Two photographs being taken of each plant.

1. Photograph of mature plant in the field;
2. Photograph of a middle and top leaf removed from the plant and pinned out.

The middle leaf was selected in the following manner. It was noted that the leaves on nearly all the plants could be divided into two types. The bottom 7 to 10 leaves were of what may be described as "typical" type, the lamina being fairly broad in proportion to the length. The upper leaves were much narrower in proportion to their length, having

somewhat strap-like appearance. The transition between these two types of leaves in the middle of the plant is usually clear cut. In each case the top leaf of the "typical" type and the top reapable leaf were photographed. These photographs which were taken with a scale gave the following information without further recording:—

Height of plant.

Height to any given leaf.

General habit of plant.

Spread.

Length and width at any point of middle leaf.

Length and width at any point of top leaf.

Distance up the plant at which leaves become of narrow type.

Width of ruffle of top or middle leaf.

These photographs gave a very accurate picture of the plant and brought out details, which in the field are not so obvious.

Great care was taken to check not only the selections made in the field, but also their curing characteristics. Special attention was paid to a number of varieties and it was possible on the season's work to eliminate a large number of the varieties tested, including practically all the new importations.

7. **Physiology.**—It is generally accepted that tobacco of superior quality is obtained from plants which grow steadily throughout the season and suffer no severe check of any kind during their growing period. To produce a crop of normal plants it is therefore necessary to find out precisely what is required to avoid any check in the growth. As far as tobacco growing is concerned one of the most important points is to know what plant foods are required and when they should be given. To ascertain what is actually happening in the plant itself and whether it is growing normally or not is a specialised line of work for a plant physiologist. This type of work was started for the first time in Southern Rhodesia by Mr. H. C. Thorpe on the Trelawney Station. A very valuable

start was made with the study of nitrogen by the application of various types of fertilisers containing nitrogen either in the organic or inorganic form. The effects of applying the nitrogen required by the growing plant before planting or in small quantities during the growing period was tested and the results were checked in a number of ways up to the sale of the cured leaf. A great deal of valuable information was obtained, but since the results of this type of experiments depends so much upon the incidence of rainfall and other climatic factors the work will have to be continued for a number of seasons before final conclusions can be drawn.

Ticks Infesting Domestic Animals in Southern Rhodesia.

By RUPERT W. JACK, Chief Entomologist.

Revised. November, 1936.

The following article aims at placing in the hands of stockmen, and others connected with the cattle industry, a popular guide to the ticks which infest stock and domestic animals generally in this Colony, together with an account of their habits, life histories, relation to animal disease and measures employed for their control. It is felt that a handy pamphlet of this nature is likely to prove useful for purposes of reference in view of prevailing legislation and the great influences that these parasites exercise on the stock industry throughout the sub-continent.

Ticks are very clearly divided into two families. There are a number of points by means of which the members of either family may be distinguished, but for our purposes it is sufficient to note that in the family (*Ixodidæ*) to which the common cattle ticks belong there is a hard shield on the back of the tick, which in the male covers practically the whole of the back and in the female a smaller area close behind the head (see illustrations of male and female ticks on Plate I.). In the other family (*Argasidæ*), of which the Spinose Ear Tick, the Tampan and the Fowl Tick are representatives (see Plate II.), this hard shield is altogether lacking. Also in the *Argasidæ,* except in the larval stages, the mouth-parts are invisible when the tick is viewed from above, whilst these parts project in front of the body in the *Ixodidæ*.

Not only do the members of these two families differ in appearance, but also in life history and habits. Ticks of the family *Ixodidæ* all have a simiar life history, which is illustrated in the diagram on Plate IV. The minute tick, as it first hatches from the egg, possesses only six legs, in contrast

to the eight borne by the later stages, and is termed a *larva.* This larva crawls up to the top of the herbage or other convenient point of vantage and is brushed off by its host (*i.e.*, the animal on which it feeds). It then inserts its mouth-parts into the skin and commences to fill itself with blood. Its skin is capable of distention, and as it feeds the larva swells up, finally becoming completely engorged. It now stops feeding and may either drop off on to the ground or remain attached to its host by its mouth-parts. In either case, the second stage of the tick gradually forms within the loose skin of the larva, the skin is finally ruptured or *moulted* and out crawls the tick in its second stage. It is now seen to possess eight legs instead of six, and is termed a *nymph.* If the moult has taken place on the host the tick has only to wait until it is sufficiently hardened before "biting in" and commencing to feed again. If the moult has taken place on ground the nymph repeats the performance of the larva, crawling up to a place of advantage waiting until it is brushed off by one of its hosts, when it once more attaches itself and commences to feed. Like the larva, it feeds to engorgement and becomes greatly swollen. Again the tick may detach itself or remain on the host and the moulting process is repeated. The ticks which emerge from the nymphial skin are now in the adult stage and for the first time the sexes are distinguishable, as already pointed out, by the back of the male being covered by the horny shield and the much smaller shield borne by the female. Shields similar in proportion to those of the females are as a matter of fact borne by both the larva and nymph, and presumably serve some purpose, such as supporting the head whilst leaving the bulk of the tick's skin soft and capable of great distention. Both the male and female attach themselves to their hosts and suck blood, but the male feeds comparatively little and does not gain conspicuously in size, whereas the female becomes greatly swollen and finally fully engorged. The female then detaches herself and falls to the ground, crawls into a convenient shelter, and soon commences to lay eggs. Several thousand eggs are produced, and in the process the female tick gradually shrivels and dies. After an interval the eggs hatch, producing larval ticks, and the life cycle recommences.

The common cattle ticks have thus three distinct stages after leaving the egg, namely, the *larva*, the *nymph*, and the *adult*. From what has been said concerning the fact that some species drop off for each moult, whilst others remain on the host for one moult or both, it is obvious that some species may feed upon three different animals during the course of their development, others on two and some only on one. It is usual to speak of them as having a one host, two host, or three host cycle. This difference in habit has, as will be seen, an important bearing on disease-transmission and on the results secured from dipping.

Having thus touched lightly on the fundamental points in the life history of the common cattle ticks, we are now in a position to deal separately with the various species prevalent in this territory and their respective peculiarities in regard to disease-transmission. The species differ from one another not only in size, form and coloration, but also in various minor characteristics, very important amongst which is the length of mouth-parts, these organs being very much longer in proportion to the body in some species than in others. This variation in the mouth-parts is clearly shown on Plate I.

The Bont-leg Tick (*Hyalomma ægyptium impressum*, C. L. Koch).—This tick, of which the male is illustrated at fig 1 on Plate I., is probably the best known of all in the territory. Unfortunately, there is a tendency to use the name "Bont Tick" in reference to it, but this name should be reserved for the species to be considered next. The Dutch word "Bont," meaning "parti-coloured" or "piebald," obviously applies only to the legs of this species, the body of the tick being dark brown. The species is readily distinguished by its banded legs and dull brown body, the surface on the male being closely shagreened all over. The unfed female is very similar in appearance to the male—in fact in this species the sexes are rather difficult to distinguish without the aid of a hand lens, as the female shield, with its rough surface, merges somewhat inconspicuously into the remainder of the tick's back, with which it is uniform in colour. The males and unfed females measure up to nine thirty-seconds of an inch in length, including the mouth-parts. The fully engorged female may measure some three-quarters of an inch in length by five-eights of an inch in breadth.

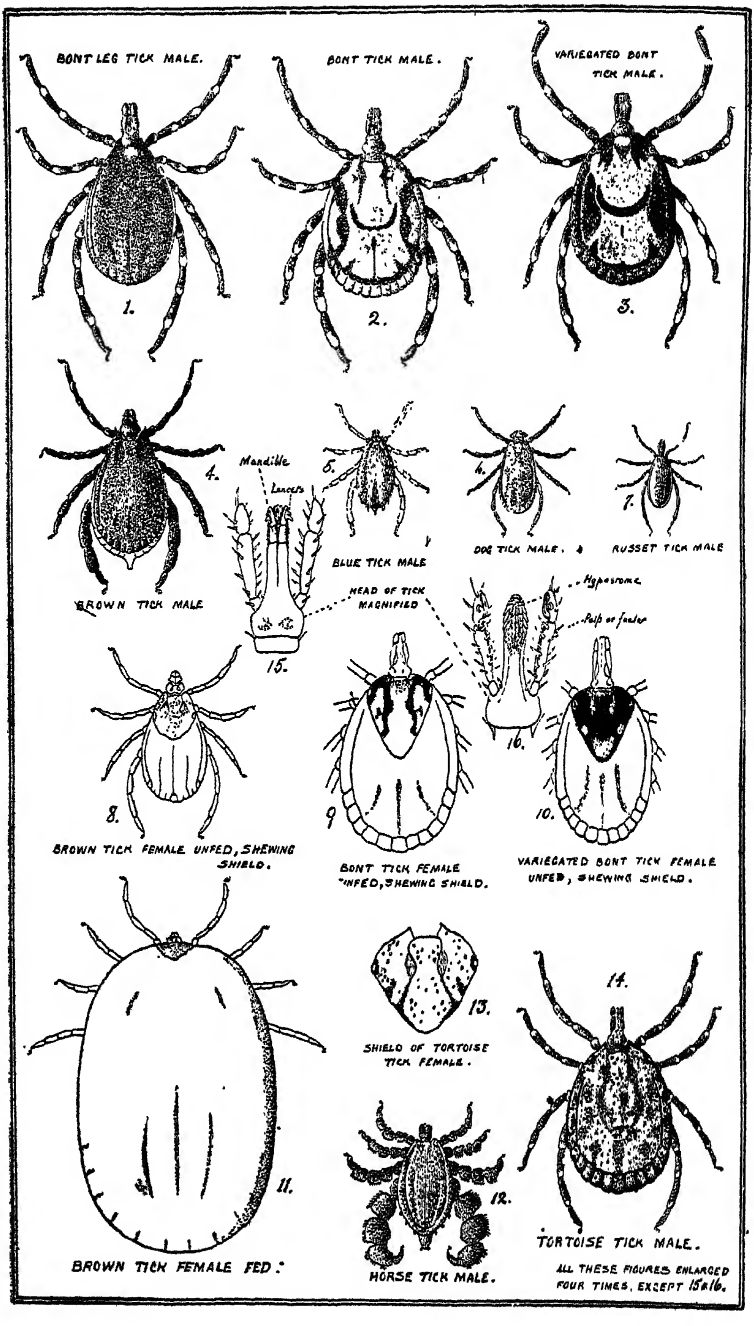

BONT LEG TICK MALE.
BONT TICK MALE.
VARIEGATED BONT TICK MALE.
1.
2.
3.
4.
BROWN TICK MALE
Mandible
Lancets
5.
BLUE TICK MALE
6.
DOG TICK MALE.
7.
RUSSET TICK MALE
HEAD OF TICK MAGNIFIED
Hypostome
Palp or feeler
15.
16.
8.
BROWN TICK FEMALE UNFED, SHEWING SHIELD.
9
BONT TICK FEMALE UNFED, SHEWING SHIELD.
10.
VARIEGATED BONT TICK FEMALE UNFED, SHEWING SHIELD.
13.
SHIELD OF TORTOISE TICK FEMALE.
14.
11.
BROWN TICK FEMALE FED.
12.
HORSE TICK MALE.
TORTOISE TICK MALE.
ALL THESE FIGURES ENLARGED FOUR TIMES, EXCEPT 15 & 16.

Plate I.

The life history of the Bont-leg tick is of the two host type, the moult between the larval and nymphal stages being passed on the host, and that between the nymphal and adult on the ground.* Although the adults are common parasites of cattle and other stock, the larvæ are not known to attach themselves to these animals, but have been reared successfully on rabbits and fowls. To these hosts they attach themselves in the region of the head. The common hare is no doubt a great factor in keeping up the numbers of these ticks on cattle runs, but other rodents must play a part, and in any case the range of hosts of the tick in its early stages is imperfectly known.

The Bont-leg tick has not as yet been found guilty of transmitting any specific disease. Its attack, in the adult stage has, however, a notorious tendency to cause abscesses and sloughing of the skin, and spots affected in this manner are believed to be specially liable to form the starting points for the so-called "Screw Worm" (*Chrysomyia bezziana*, Villen.) which has caused so much trouble amongst cattle of recent years.

The African hosts recorded for the adults of this species include the domestic ox, Cape buffalo, dromedary, rhinoceros, horse, ass, giraffe, sheep, goat, pig, dog, cat, man, domestic fowls and ostriches. The larvæ and nymphs are recorded from hares, rabbits, fowls, ostriches and other birds.

The Bont Tick (*Amblyomma hebræum*, Koch).—The male of this species is easily recognised by the pattern on the shield, the dark markings being dark brown, nearly black, and the lighter portions pale green in the middle merging into pale yellow towards the edges (see Plate I., fig. 2). The legs are banded as in the preceding species. In the female the markings on the shield are more variable. The plan of the markings on a specimen in the Departmental collection is shown at fig. 9 on Plate I. Prof. Neumann, the French authority on ticks, described the shield as exhibiting a large light spot towards the hinder end, and other small ones

*It has been shown that this species may or may not drop off for the first moult, so that its cycle is of either the two host or three host type. Individual variation in habit of this nature has not been noted in connection with other ticks.

towards the sides. The remainder of the back of the tick in the unfed female is dark brown.

The length of the males and unfed females, including the mouth-parts, is about one-quarter of an inch. and the breadth about three-sixteenths of an inch. The engorged female usually measures about three-quarters of an inch long by five-eighths of an inch in breadth.

The life history of the Bont tick is of the three host type, both moults being passed through away from the host. The larvæ and nymphs feed on the same hosts as the adults. The duration of the different stages has been worked out in detail by Mr. C. P. Lounsbury in the Cape Colony. The female tick lays an enormous number of eggs, upwards of 17,000 having been computed in a single batch. The incubation period of the eggs varies very greatly with the temperature. In the winter it may occupy six months or more, and in the summer a period of about eleven weeks has been noted. The larva feeds for from four to nine days, but usually six or seven, before detaching itself, to drop to the ground for its moult. At this stage of its development it measures about one-twelfth of an inch in length. The time occupied in the moulting process varies in relation to the temperature and possibly other factors. It has occupied as little as sixteen days, when the ticks were kept in an incubator, and several months during the winter at ordinary atmospheric temperature. In nature it is thought that the period would vary between one to three or more months. The nymph or second stage tick engorges in from four and one-fourth to eight days, and like the larva drops to the ground for the ensuing moult. Lounsbury mentions periods of eighteen, twenty-two, twenty-four and twenty eight days for this second moult, but adds that the time varies considerably with individuals, some treated in exactly the same way taking a fortnight longer than others over the process. This second moult brings the tick to the adult stage. The females only bite in readily next to a male that has been attached for some days. They then take some seven or eight days to feed to repletion and drop off to lay their eggs on the ground. The males remain attached to the host for a prolonged period.

As far as the complete life cycle is concerned, Lounsbury judges that in the Cape Colony there cannot be more than one complete generation in a twelvemonth, and that "under exceptional circumstances two full years might pass and the cycle be still incomplete."

The Bont tick is found mainly in south-eastern and eastern Africa. Until recent years it was not known to occur naturally in Southern Rhodesia, but since this article first appeared in the *Rhodesia Agricultural Journal* the distribution of the Bont tick has extended greatly in Southern Rhodesia. This distribution now includes the greater part of Matabeleland, comprising certain parts at least of the following districts:—Ndanga, Chibi, Victoria, Nyamandhlovu, Bubi, Insiza, Mzingwane, Gwanda, Matobo, Bulalima-Mangwe, Bulawayo and Belingwe.

The above information was kindly supplied by the Chief Veterinary Surgeon.

As far as can be judged at present there are few parts of the Colony which this tick would be incapable of inhabiting. The serious position which may be created by the prevalence of Heartwater in any area makes it desirable that an attempt be made to obtain further data bearing on the question of the potential ultimate distribution of the Bont tick in this Colony.

The Bont tick was originally shown by Lounsbury to be the transmitter of the disease known as Heartwater, which attacks sheep, goats and calves in parts of the South African Union. The tick conveys the disease from stage to stage, and not through the egg, that is to say, larvæ and nymphs which feed on a sick animal acquire the virus of the disease, and the resulting nymphs or adults, as the case may be, transmit the disease when they "bite" susceptible animals.

The Bont tick in the adult stage has been recorded from cattle, sheep, goats, swine and horses, amongst domestic animals, and rhinoceros, giraffe, various antelopes, buffalo, lion, wild dog and other carnivora. It has also been found on a "monitor" lizard.

The Variegated Bont Tick (*Amblyomma variegatum*, F.)—The handsome male of this species is shown at fig. 3 on Plate I., and a diagram of the female illustrating the shield markings at fig. 10. Although the shield markings of the male are on very much the same plan as those of the preceding species, there is no risk of confusing the two. The edges of the shield in the Variegated Bont Tick are dark, whereas those of the Bont tick are pale. Furthermore, the light markings on the shield in the present species are coppery red instead of pale green shading into yellow towards the edges as in the case of the true Bont tick. Entomologists also find a distinction in the "eyes," which are flat in the Bont tick but prominent and provided with a slight orbit in the "Variegated" species. The dark markings are also distinctly raised above the general surface of the shield, and there is a green tinge at the edges of these markings. The markings on the female shield are very variable, and frequently the whole shield is dark without any light patches. In size and life history, as far as the latter is known, this species resembles the Bont tick, although the engorged females are recorded as attaining even greater dimensions. This tick is found in certain parts of Southern Rhodesia, notably in the region near the Victoria Falls (Matetsi, etc.) and along the eastern border of the Colony.* It appears to be absent from the central plateau.

This species has been shown to be able to transmit Heart-water. It is also reported to be very apt to cause abscesses and sloughing of skin in the host, as also is the true Bont tick. This tendency, in fact, seems to be common to the large species of ticks furnished with long mouth-parts.

The Tortoise Tick (*Amblyomma marmoreum*, Koch).—The male of this species is shown at fig. 14 on Plate I., and the female shield at fig. 13. The adults are common on reptiles, particularly tortoises, hence the popular name; but they also attack warm-blooded animals. The larvæ and nymphs feed very readily on warm-blooded animals. This species was reared at Cape Town during the time the present writer was

*Robinson describes this species from the eastern part of the Colony as a distinct variety—A. variegatum var. nocens. In a popular article it appears unnecessary, however, to distinguish between the variety and type, as the former conforms to the brief description given above.

assistant to Mr. C. P. Lounsbury, and the life history was found to be similar to the Bont tick, each stage dropping from the host for the moults. The engorged females may attain a considerably greater size than those of the Bont tick, and the unfed males and females also average rather larger. The Tortoise tick occurs in this Colony, but does not appear to be very abundant. It is recorded from the Cape up the east coast to the Congo and in West Africa (Senegal). Neumann records rhinoceros and genet as warm-blooded hosts, as well as tortoise and python.*

Another species of *Amblyomma*, namely, *A. gemma*, Donitz, has been found on a bull in the Umtali district (1932). It is recorded on cattle, rhinoceros, eland, zebra and lion in Kenya.

Two relatively rare species of ticks recorded of recent years on domestic animals are: (1) *Rhipicentor nuttalli*, Cooper and Robinson, found on a dog in the Makoni district (1934). This species is recorded on kudu, hedgehog and dog in the Union of South Africa.

(2) *Rhipicentor gladiger*, Neumann, was taken on a dog in Gutu district in 1933.

The Brown Tick (*Rhipicephalus appendiculatus*, Neum.) **and its Relatives.**—The Brown Tick, well known in connection with the transmission of East Coast Fever, is shown on Plate I., the male at fig. 4, the unfed female at fig. 8, and the fed female at fig. 11. There are, however, a number of different species of this genus in the Colony, and most of them resemble the Brown Tick so closely that none but those who have made a study of ticks are likely to distinguish one from the other. With many species even specialists experience considerable difficulty, particularly with the females. The writer has therefore thought it unprofitable to figure more than one species. The Brown Tick is, generally speaking, the commonest cattle parasite of the genus, although the "Black-pitted Tick" (*R. simus*, Koch) is also common on this host, as also is the "Red-legged Tick" (*R. evertsi*, Neum.). The latter is an easily recognised species owing to its saffron

*This species has since been taken in numbers from rhinoceros in Southern Rhodesia.

coloured legs, the legs of the other representatives of the genus being dark brown. The adults of the *Red-legged Tick* attach themselves by preference under the tail of the host, whilst nymphs are mainly found deep in the ears. On this account the nymphs have frequently reached the writer with a request for a statement as to whether they are specimens of the Spinose Ear Tick or not. The adults of the Brown Tick are also found on the ears of their hosts, although they do not penetrate so deeply as the Red-legged Tick nymphs, and are also sometimes suspected of being Spinose Ear Ticks. As will be seen later, both forms are very distinct from this latter species, which belongs to the other family of ticks (*Argasidæ*).

Both males and females (unfed) of the Brown Tick and its local relations (excluding the Red-legged Tick) are of a uniform dark brown colour. The size is variable. The male from which fig. 4 on Plate I. was drawn measures almost exactly three-sixteenths of an inch in length, and this is about the maximum size. Many specimens are much smaller. It is noteworthy that specimens taken from antelope and other wild animals all appear to be on the small side. The specimen figured was taken, in company with others of similar dimensions, from cattle at Salisbury, the unfed females of the same batch being rather smaller.

The name *appendiculatus*, given to this species by Prof. Neumann, refers to the prominent projection on the hinder margin of the male. This may develop, but does not always do so, as the tick feeds, being absent in unfed specimens. Other species of the genus also develop projections, but usually less prominent than that of the Brown Tick. This peculiarity is also found in the genus *Boophilus*, which includes the Blue Tick, to be dealt with later.

The life history of the Brown Tick and several other members of the same genus has been worked out in detail. The other members include the Black-pitted Tick (*R. simus*, Koch), the Cape Brown Tick (*R. capensis*, Koch), and the Red-legged Tick (*R. evertsi*). The Cape Brown Tick is not known to occur in this Colony. Of the four species mentioned, three show life histories of the three host type, falling from

the host for both moults. The Red-legged Tick has, however, a two host cycle, remaining on the animals for the first moult, but falling off for the second.

The Brown Tick larva may occupy as little as three days in feeding to repletion, but frequently takes considerably longer. When full fed it is about the size of a pin's head, and drops off for its moult, which may take a fortnight or more, depending on the temperature, etc. The resulting nymph, after attaching itself to an animal, feeds to engorgement in some 4—6 days or longer, and again falls off for the moult, being now about the size of a lentil. The female, providing she meets a male at once, swells to repletion in about nine days, and drops off to lay her eggs on the ground. The swollen female may be distinguished from the Blue Tick female by its dark brown legs and bluer colour, the Blue Tick having pale legs and a somewhat greenish tinge. The time occupied by the moults and hatching of the eggs varies greatly with the time of year, and Lounsbury estimates that not more than two full generations can be passed during the year under the most favourable circumstances.

The above notes apply to the other species of the genus which have been studied, with the exception of the Red-legged Tick. In this species the nymphs begin to fall from the ear about ten days after the larvæ have "bitten in," and the larval and nymphal stages are thus passed in a considerably shorter time than in the case of species which fall off for the first moult.

The four species of this genus mentioned above have all been found capable of transmitting East Coast Fever, and it is probable that some, if not all, other members of the genus which feed on cattle are capable of playing a similar part. The method of transmission is similar to that of the Bont Tick and Heart-water. A tick feeding on a sick animal in the larval stage and "biting" a susceptible animal in the nymphal stage may convey the disease, as may also occur if the nymph feeds on a sick animal and the resulting adult feeds on a susceptible animal. The disease does not pass through the egg stage, and recovered animals have under test invariably failed to infect ticks. It is noteworthy that if a larva feeds on a sick animal and the resulting nymph engorges on an animal,

such as a dog, hare, goat or sheep, which is immune to the disease, the infection is lost and the adult is not capable of infecting a susceptible animal.

The Brown Tick has been shown to transmit Redwater in cattle either as an adult, which fed on an infected animal in the nymphal stage, or as a larva, whose mother fed on an infected animal. It can also transmit the form of gallsickness in cattle caused by the organism *Gonderia mutans*, but the mode of transmission in this case is not stated.

The Red-legged Tick can also transmit gallsickness caused by *Gonderia mutans*. It plays a more important role, however, in transmitting biliary fever of the horse. These diseases are transmitted by the adults which have fed on infected animals in the larval and nymphal stages, both of which, as already stated, are passed on one host. In addition to the above, the larvæ can transmit ordinary Redwater in cattle and the disease known as *Spirillosis* caused by *Spirochæta Theileri*, affecting cattle, sheep and horses, when the mother tick has fed on an infected animal.

The Black-pitted Tick can transmit ordinary gallsickness (*anaplasmosis*) amongst cattle.

The European Brown Tick has been shown in India to transmit biliary fever of the dog, which it may do in three ways, at least:—(1) adult females feed on an infected animal and the nymphs of the next generation are infective; (2) nymphs feed on an infected animal and the adults are infective; and (3) adult females feed on an infected animal and the adults of the next generation are infective.

It will be seen, therefore, that ticks of the genus *Rhipicephalus* are amongst the most important in regard to disease transmission.

The following is a list of the species of the genus which have been collected in Southern Rhodesia and identified, together with the African hosts recorded in respect to each:—

(1) *Brown Tick* (*R. appendiculatus*, Neum.).—Ox, sheep, goat, horse, ass, Cape buffalo, dog, koodoo, sable antelope, wart-hog.

(2) *Black-pitted Tick* (*R. simus*, Koch).—Dog, lion horse, ox, Cape buffalo, dromedary, S.A. river-hog, wart-hog, porcupine, bush-pig, sable antelope, koodoo, cat.

(3) *Red-legged Tick* (*R. evertsi*, Neum.).—Ox, horse, ass, mule, zebra, sheep, goat, giraffe, dog, jumping shrew, sable antelope.

(4) *European Brown Tick* (*R. sanguineus*, Latr.).—Dog, jackal, civet-cat, lynx, cat, lion, man, hare, hedgehog, dromedary, waterbuck, sheep, goat, ox, scaly ant-eater, ostrich, owl, ibis, tortoise. This tick is very common on dogs at Salisbury and in other parts of Mashonaland.

(5) *R. sulcatus*, Neum.—Dog.

(6) *R. supertritus*, Neum.—A number of specimens were collected in 1910 off the grass near Gatooma, but the host is not known to the writer.

The Blue Tick (*Boophilus decoloratus*, Koch).—This species is readily distinguishable from other common cattle ticks by its pale legs. The male and unfed female are considerably smaller than the species already dealt with, although the fully engorged female is not so markedly inferior in size to the engorged Brown Tick female. The male measures roughly about one-eighth of an inch in length, and is of a greenish blue colour, with a well developed "tail" when fed, as in the Brown Tick. The points of the plates on the under surface of the body frequently show when the fed male is viewed from above (see Plate I., fig. 5). The fed female is somewhat greenish blue in colour in contrast to the slaty blue of the Brown Tick female, and the shield is smaller. The easiest guide lies, however, in the pale legs.

The life cycle of the Blue Tick is confined to a single host, the tick remaining in position for *both* moults. The cycle is a rapid one compared with most other ticks, as the natural heat of the host causes the tick to be much less influenced by the weather during the moults. The fully fed females usually commence to fall about twenty-one days after the larvæ have "bitten in," but the bulk appear to mature between the twenty-third and the twenty-fifth day. The female, of course, lays her eggs, like other ticks, on or in the

ground, and their hatching period is influenced by atmospheric conditions. Under natural conditions there are, however, undoubtedly several generations during the year, and in the absence of dipping the Blue Tick is, as a rule, the commonest species. On the other hand, where dipping is practised it tends to disappear sooner than any other species on account of the lengthy period it spends on its host at a time, which exposes it to repeated immersions.

The Blue Tick transmits the cattle diseases Redwater and Gallsickness (*anaplasmosis*). It has also been shown to be an agent in the transmission of *Spirillosis*, affecting horses, cattle and sheep. The disease is taken up by the tick when feeding on a sick or recovered animal, and its conveyed by the larvæ of the next generation when they attach themselves to a susceptible animal. The infection thus passes through the egg stage.

This species has been recorded on the following animals:—Ox, horse, sheep, goat, dog, koodoo, impala, sable antelope.

The Horse Tick (*Margaropus withemi*, Karsch.).—This relative of the Blue Tick is not known to occur in Southern Rhodesia, but may do so. It is a South American species, and probably came to Africa with horses from the Argentine during the Boer War. Little is known concerning its habits. It was first found in South Africa infesting horses in the Cape Colony, and was described by two separate authorities as a new species under the names of *Rhipicephalus phthirioides*, C. & R., and *Margaropus lounsburyi*, Neum. The bizarre form of the male (see Plate I., fig. 12) suffices to distinguish it from other known ticks, but the females are superficially similar to, although somewhat larger than, the common Blue Tick. The legs have, however, a striped appearance through the presence of dark markings towards the outer end of each article.

The tick has been recorded on horses and cattle and has been introduced to this Colony in the past. The specimens in the departmental collection were taken on cattle imported from Middleburg, Cape Province.

The Dog Tick (*Hæmaphysalis leachii*, Aud.).—This is probably the commonest tick found on the dog in this Colony

as elsewhere in South Africa, but dogs are sometimes seen much more heavily infested with *R. sanguinius* or *R. simus* adults.

The male of the dog tick (see Plate I., fig. 6) is about the same size as that of the Blue Tick, but is of a uniform brown colour, including the legs. The engorged female attains very much the same size as that of the Blue Tick, but is more slaty blue in colour. Although distinguishable at a glance from the Brown Tick and its allies to those familiar with the characteristics of ticks, there is no very broad distinction to guide the uninitiated. The head of the Dog Tick is, however, shorter and broader than that of the Brown Tick, the male does not develop a "tail," and the shield on the male bears a deep uniform groove close to and parallel to the edge, completely bordering the shield except in front.

The life cycle of the Dog Tick is of the three host type, the tick falling off for both moults. There are probably two generations during the year as in the case of the Brown Tick.

The Dog Tick is known to transmit the diseases known as Malignant Jaundice or Canine Piroplasmosis. The disease is closely related to Redwater in cattle. The mode of transmission discovered by Mr. C. P. Lounsbury at the Cape is unique. Adult females fed on a sick or recovered animal take up the infection, but the larvæ and nymphs of the next generation are, as a rule, incapable of transmitting the disease. When the adult stage is reached, however, the ticks are infective and capable of giving the disease to a susceptible animal, if they happen to attach themselves to such.

The hosts recorded for this tick are mainly carnivora, namely:—Domestic dog, jackal, domestic cat, lion, leopard, genet, civet-cat, mongoose and scaly ant-eater.

The Russet Tick (*Ixodes pilosus*, Koch).—The popular name given to this species refers to the colour of the engorged female, which is of russet rather than the usual bluish colour of ticks of similar size. The males measure about one-tenth of an inch in length including the mouth-parts, and the species is the smallest with which we have to deal. The engorged female is of a peculiar shape, being considerablly broader behind than in front. The male is figured on Plate I. at

fig. 7, and may be recognised by its small size, the long narrow mouth-parts, the brown colour, the deep groove round the shield, and the absence of festoons on the posterior part of the shield. The long narrow mouth-parts and the colour also serve to distinguish the female. This species was reared years ago, by Mr. C. P. Lounsbury at the Cape, and found to drop off for both its moults, having thus a three host cycle. All the specimens in the departmental collection were taken on the domestic dog, and it is possible that the tick may also be concerned in the transmission of Malignant Jaundice. An allied species (*I. ricinus*, Linn.) transmits Redwater amongst cattle in Europe. The Russet Tick is stated to cause a disease of sheep of the nature of paralysis in the Cape Province.

In addition to the dog the following hosts are recorded, and it may be stated that experience elsewhere does not indicate the dog as necessarily the favourite host, the tick being found abundantly on cattle and small stock—cattle, mules, horses, pigs, goats, sheep, bushbuck, duiker, cat and leopard.

Besides the ticks we have dealt with, a number of other species of the family *Ixodidæ* have been found in the Colony, but as they are not known to feed upon domestic animals they do not interest the stock owner and are therefore omitted.

We have now to deal with the second family of ticks (*Argasidæ*), of which three species claim our attention. Before proceeding, however, it is necessary to point out that the ticks of this family show a more varied life cycle than those of the preceding family, and their feeding habits are in many respects different. These peculiarities will be dealt with under the heading of each species. As already indicated, these ticks are distinguishable from the common cattle ticks and the other members of the *Ixodidæ* by the absence of a horny shield and the fact that the mouth-parts (except in the larvæ) are hidden under the body when the tick is viewed from above.

The Spinose Ear Tick (*Ornithodoros megnini*, Duges.).—This tick was originally described and studied in America and is no doubt an introduction to South Africa. It occurs in parts of the South African Union, but no specimens taken

in Southern Rhodesia have as yet reached the writer. It is likely to come to light in the Colony at any time, however, and many specimens suspected of belonging to this species have been forwarded, only to prove to be examples of ear-infecting ticks belonging to the other family.

The name "Spinose Ear Tick" refers to the favourite feeding site of the early stages of the tick, and the short spines that cover the body of the nymph (see Plate II., figs. 3 and 4). These spines are lost in the adult stage.

The larvæ (see Plate II., figs. 1 and 1a) as they hatch from the eggs are six-legged, as is the case with all ticks. They attach themselves to their hosts after the manner of the common ticks and feed to repletion in about five days, swelling greatly in the process (see Plate II., fig. 2). Remaining attached, they moult their skins after an interval and the nymphs appear (see Plate II., fig. 3). These attach themselves again and also feed to repletion, taking from 35 to 98 days, and swelling very greatly (see Plate II., fig. 4). It has been stated that the nymphs do not moult during the feeding process, but in a recent publication* this is apparently called into question, the idea being that the nymphs moult without leaving the host. The full-fed nymphs leave the host and "crawl up several feet on posts, trees or the like, and hide in chinks and crevices." The nymphs shed their skins after some seven days in summer, and the adults appear (see Plate II., fig. 5). The adults do not feed, and remain smaller in size than the full-fed nymphs. The eggs are laid in the crevices where the adults live, and the larvæ which hatch out seek a host and recommence the life cycle.

Some recent observations in South Africa indicate that fed nymphs do not necessarily climb to find a crevice in which to moult, but that they, and the adults and larvæ, may be found in any convenient shelter in a stable or kraal, even if it be on the ground. This species of tick is a denizen of places where animals congregate regularly and may attain great numbers in such localities, but does not infest the open veld to any serious extent. Moreover, it does not appear to

*"Ticks," by Nuttall, Warburton, Cooper & Robinson. Part II., p. 330.

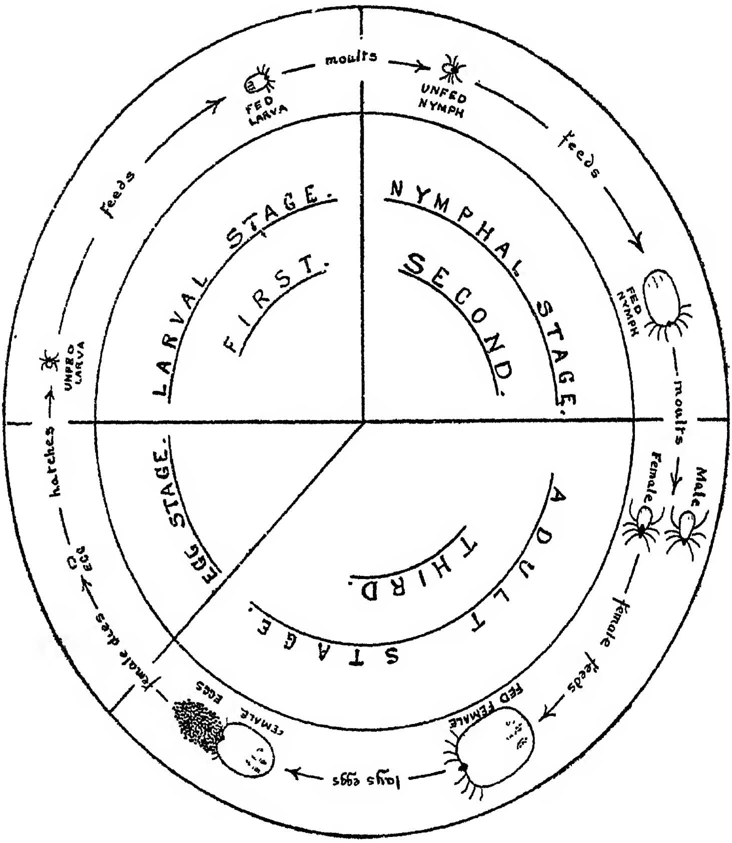


DIAGRAM ILLUSTRATING THE LIFE CYCLE OF A CATTLE TICK.

thrive much in localities favoured with an abundant rainfall, and would appear more likely to establish itself in the western and southern parts of this Colony than in Mashonaland.

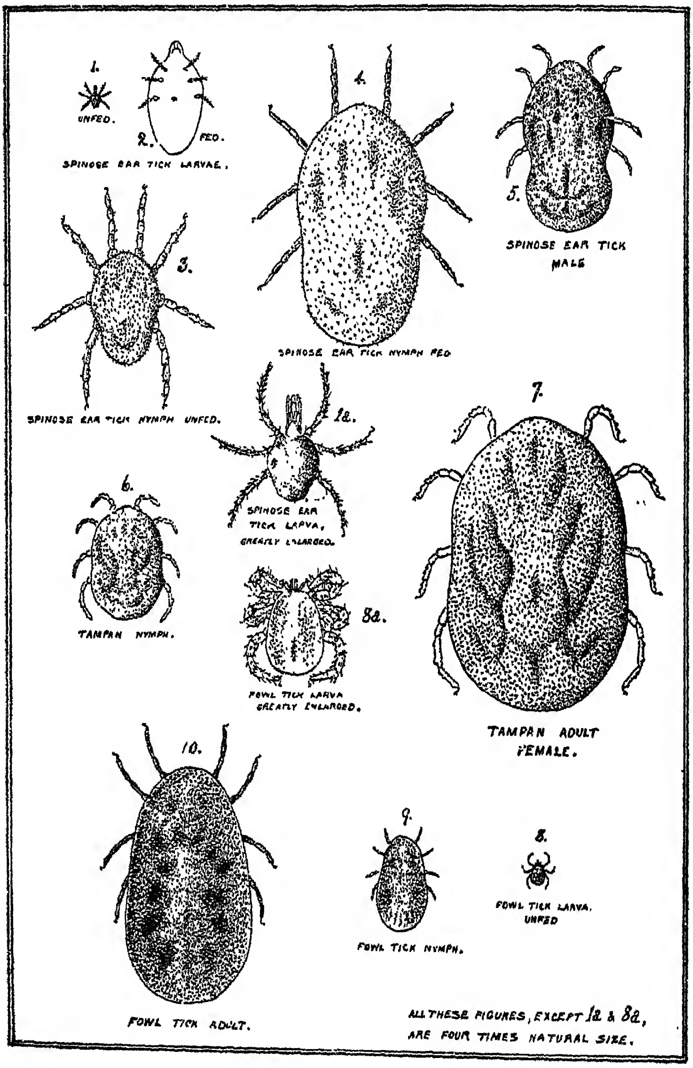
As methods of controlling ticks are to dealt with later, nothing need be said on this subject here. The Spinose Ear Tick is not known to transmit any specific disease, but its presence in the ear causes great irritation and loss of condition in stock; young animals have been known to succumb to very heavy infestation.

This species has been found infesting the following hosts: Cattle, sheep, goats, horses, donkeys, dogs, cats, ostriches and man, but it is chiefly a pest of cattle and small stock.

The Tampan (*Ornithodoros moubata*, Murray).—This is the largest of the three species belonging to this family with which we have to deal. It resembles the Spinose Ear Tick more closely than it does the following species, but may be distinguished in the nymphal stages by the absence of spines on the body, and the fact that it does not normally infest the ear, nor remain attached to its host for any length of time. The adults are readily distinguished by the shape, the Spinose Ear Tick adult being "fiddle-shaped," with a strong constriction in the body, whilst the Tampan adult shows little trace of such a constriction.

The life cycle and habits of the Tampan differ considerably from the preceding species. The larva does not hatch out from the egg, but *moults within*, and the young *nymph* which emerges is the first *active* stage of the tick. The nymphs feed intermittently, remaining hidden in crevices during the day and sallying forth after the manner of a bed-bug to suck the blood of their victims at night. They moult several times in the course of their development, gaining in size, and finally reaching the adult stage. The adults, unlike the preceding species, also suck blood freely, and the female is stated to moult her skin repeatedly. The eggs are laid in the chinks and cracks where the ticks congregate, the female laying a small batch after each feed.

The Tampan is best known as a pest of man, transmitting the disease known as African relapsing fever (*Spirochætosis*). It will, however, attack animals when opportunity occurs, and


1.
UNFED.
2.
FED.
SPINOSE EAR TICK LARVAE.
4.
5.
SPINOSE EAR TICK MALE
3.
SPINOSE EAR TICK NYMPH FED
SPINOSE EAR TICK NYMPH UNFED.
1a.
7.
6.
SPINOSE EAR TICK LARVA, GREATLY ENLARGED.
8a.
TAMPAN NYMPH.
FOWL TICK LARVA GREATLY ENLARGED.
TAMPAN ADULT FEMALE.
10.
9.
8.
FOWL TICK LARVA. UNFED
FOWL TICK NYMPH.
FOWL TICK ADULT.
ALL THESE FIGURES, EXCEPT 1a & 8a, ARE FOUR TIMES NATURAL SIZE.

the writer found in 1912 swarming in some extensive pig-styes in Matabeleland. It seems to be common in all parts of the Colony as a pest in native huts, especially perhaps those habitually used by travelling natives. The hosts need not be specified, as the tick will, when hungry, certainly feed on almost any warm-blooded animal, or even bird, that affords it an opportunity.

The transmission of African relapsing fever by the tick has been successfully studied. The female sucks blood containing the organisms, and "the latter pass into the ovaries of the tick and penetrate the undeveloped eggs, where they multiply. They persist in the tick which develops from the egg and pass out of its mouth-parts when it feeds in the first nymphal stage on a fresh host." The infected tick may harbour the organism and transmit the disease for months, and the organism is stated to be transmitted to the third generation of ticks, even though the second generation feeds on blood free from the organism.

The Fowl Tick (*Argas persicus*, Oken.).—This well known pest of fowl houses in the Colony may be distinguished in the nymphal and adult stages from both the preceding species by the flat back which meets the under surface of the body at a sharp angle, forming a definite edge all round the body. The name "Tampan" is frequently applied to the Fowl Tick, but should be reserved for the preceding species to avoid confusion.

The habits and life cycle are similar to those of the Tampan, with the important exception that the Fowl Tick larva hatches as such from the egg and is an active parasite. It attaches itself to its host and remains for some five to ten days, being commonly found under the wing. When fully engorged this larva is about one-twelfth of an inch in length. It now drops off its host and in about eight days in summer moults its skin and the nymph appears. The habits of the tick are now similar to those of the Tampan, already described. Mr. C. P. Lounsbury, who worked out the life history of this tick at the Cape, reared it from egg stage to the following egg stage in ten months.

The Fowl Tick transmits the fowl disease *Spirochætosis*, which is very prevalent in this Colony. It appears that after a tick has fed on infected blood, the organisms multiply in its body and it is able to infect any susceptible bird it feeds on for six months or more afterwards. Apart from its power to transmit disease, the tick is a very serious pest on account of direct injury inflicted, and the writer has seen cases in which fowls, introduced to badly infested premises, died of exhaustion within two days.

The tick is stated to be a pest of man in Persia, but in African experience it is pre-eminently a poultry pest, attacking fowls, geese, turkeys, ducks, pigeons and even canary birds.

THE MOUTH PARTS OF TICKS.

It may interest the reader to know something of the structure of the mouth parts of ticks. As is well known, a tick when pulled off an animal or human being frequently either leaves its "head" behind or brings away a small piece of skin and flesh with it. A study of fig 16 in Plate I. will indicate why this occurs. The "beak" of the tick which enters the skin (marked "hypostome" in the figure) is armed with a series of backward projecting processes, each one like the barb of a fish hook. It is evident that although this may be pushed comparatively smoothly into the skin, it cannot be pulled out forcibly without something giving way. It is by means of this beak or hypostome that the tick is anchored to its host during the process of blood-sucking. It could not possibly maintain its position during the process of engorgement by the power of its legs alone, as these are, as a matter of fact, comparatively useless to a swollen tick whilst on its host.

The mode of insertion of the barbed beak is also a matter of interest. It is conceivable that a tick might simply push it in whilst maintaining a grip with its hghly prehensile feet, but none the less this is probably a mechanical impossibility, because there is an elaborate and rather beautiful contrivance for assisting the passage of the beak into the skin. This contrivance is shown in fig. 15 on Plate I. The under side of the beak alone carries the backward-pointing barbs. On

its upper surface lie the modified mandibles, bearing a few outward directed recurved lancets at their extremities. These mandibles are capable of being thrust out beyond the beak and are attached to muscles which admit of their being drawn back strongly until the beak projects well beyond them. The tick, seeking to attach itself to its hosts, thrusts out the hooked mandibles, and, the portion bearing the hooks at the extremity being movable, commences to cut a hole in the skin, into which the beak is worked. The mandibles continue to cut a way for the beak until the latter is buried up to its base. The palps or feeders do not enter the skin, but are spread apart on the surface as the beak enters.

The fundamental characteristics of the mouth parts are common to all ticks, whichever family they belong to, but there are considerable minor modifications in respect to the length and shape of the hypostome, and the completeness or otherwise of its armament of barbs. Ticks, like the nymphal and adult stages of the Fowl Tick, which feed quickly, have few barbs on their beaks, as they do not require to anchor themselves so firmly as the Ixodid ticks, which feed over a considerable length of time. The adults of the Spinose Ear Tick, which do not feed at all, have reduced mouth parts with an unarmed beak.

(To be continued.)

A Note on Witchweed Control.

By S. D. Timson, M.C., Assistant Agriculturist.

The writer is frequently questioned by farmers as to the advisability or otherwise of mixed sowings of a trap-crop such as Amber Cane or Sudan grass with the green-manure crop, such as sunnhemp or sunflowers, on witchweed infested land, and in this note the *pros* and *cons* of the practice are discussed.

It may be said at once that the practice cannot be recommended, and the disadvantages of it are discussed below.

I. If a mixed sowing of a trap and a green-manure are made, then they must be ploughed under as soon as the witchweed germinated by the trap crop commences to flower, or as a rule soon after two months from germination. If bad weather delays ploughing the witchweed will set seed, and the result is a serious increase in the infestation by the parasite instead of a decrease. Witchweed obviously cannot be economically hoed or hand collected from a thick stand of sunnhemp or sunflowers, and a trap crop.

II. If the mixed crop is ploughed under at the correct time to prevent the seeding of witchweed, then the green-manure is not given the full period of growth to yield its best result as a green-manure.

III. The majority of farmers nowadays sow their green-manures "dry" before the seasonal rains arrive, and if this practice is followed with a mixed sowing of trap and green-manure this, if weather permits, will be ploughed under within two months from germination, normally between mid-January and the end of January. At this stage of growth (two months from germination) the mixed crop is still soft and has a high nitrogen content, and will therefore rot down very rapidly in the soil, and the insoluble organic nitrogen will be converted into the soluble nitrate form, and will be to a serious extent lost by leaching out by the rains in February and March.

IV. If the date of sowing the mixed crop is delayed to avoid the nitrogen loss mentioned in III. above, then the farmer must face the extra expense of keeping the land free of weeds until he plants, and this at a time when he is busy planting his maize and other crops.

V. If the eradication of witchweed is the main object of the farmer, and it normally will be, then the mixing of a non-host crop with the trap crops will seriously interfere with the growth of the trap and prevent it doing its work of germinating witchweed.

Despite what has been said above it is possible that in the future it may be found under special circumstances to be worth while to make mixed sowings of a trap and a legume green-manure on badly exhausted soil, or on soil seriously eroded. On such soils the sowing of a trap alone is a waste of time and money, unless it is supplied with a complete fertiliser. If a legume green-manure alone is sown on such soils only dressings of phosphate and potash will normally be required to ensure its proper growth. A trap crop, however, would also require nitrogenous fertiliser in addition, and this is most expensive to purchase. There is a possibility that if a trap is grown in combination with a suitable legume on such soils, that the legume (such as sunnhemp) might be able to supply sufficient nitrogen from the air both for itself and for the trap crop through the activities of the bacteria in the nodules on its roots.

At present this possibility has not been investigated, but should it prove of practical value, the objections mentioned under Sections I., III. and IV. would still apply to this practice, and for that reason it is doubtful whether the practice will ever be adopted.

POULTRY PARASITES.

By H. G. Wheeldon, Poultry Officer.

It appears from a survey of the disorders affecting poultry that the effects of poultry parasites, internal and external, are very marked and should not be overlooked by poultry producers. These parasites may cause general unthriftiness followed by low productivity among fowls, and although not always producing fatal results, they may in severe cases cause debility or even mortality in the flock. Young stock are usually more severely affected.

Although internal parasites are much less troublesome in Rhodesia than in many other countries the extent to which they do exist under unfavourable conditions is not surprising. It is generally considered advisable when poultry are found to be unthrifty for no apparent reason, to first ascertain the condition of the stock and whether they are affected externally or internally by parasites.

The group known as external parasites, such as lice, thrive upon the skin surface of the body; others visit their host only for food, such as fowl ticks and mites. Internal parasites on the other hand are those that live on the tissues within the body of the bird, as for example intestinal worms. The intestinal tract, gizzard and other internal parts may become infested. Those affecting the intestinal tract are the most common and serious results follow when large numbers occur. These parasites are commonly referred to as round or tape worms. Other internal parasites such as gape worms are not generally found in Rhodesia.

Intestinal worms in small numbers may be present in the majority of flocks without doing any obvious harm, but the possibility of their increasing must of necessity be considered, for if the conditions become favourable mild cases may be converted into serious infestations.

Cleanliness in the houses and surroundings is the watchword and should be strictly adhered to at all times in the poultry plant. Sunlight is the best germicide we have and dry well ventilated houses and runs minimise the propagation of internal parasites. Dark, ill-ventilated houses with an accumulation of filth and damp runs form ideal grounds for poultry parasites of all descriptions. It is no wonder that poultry kept under such conditions prove to be unthrifty and unprofitable.

The intention of this article is to cope only with parasites which are common in Rhodesia. The gape worm, for example, which causes gapes in chickens, is unknown in this Colony, but in countries with humid atmospheric conditions and where earth-worms, the host of the gape worm, are plentiful, it is very common and causes great mortality. This also applies to other parasites not of importance in this Colony.

Internal Parasites.—These are usually found in the intestinal tract and for ordinary purposes they may be classified into two groups, namely, (1) Nematoda or round woms, (2) Cestoda known as the ribbon, segmented or tape worm.

The control of these parasites and treatment of infested stock should be directed respectively to sanitation and disinfecting the house and runs to minimise their propagation, dosing the stock to expel the worms, and their destruction so as to prevent re-infesting the flock. Clean out the houses and runs thoroughly and burn all refuse. Spraying the houses and runs with disinfectant or strong salt solution will destroy the eggs and worms with which it comes in contact. The utensils should at all times be kept clean and the birds prevented from standing in the mash hoppers or stepping into the water vessels. Where it is customary to feed termites to poultry, the mounds chosen for chopping up should be some distance away from the site of pens, as they are then not so likely to transmit intestinal parasites. Ants near the pens should be destroyed.

(1) **Round Worms** are the most common of poultry internal parasites, and of these there are several different kinds affecting the internal organs, chiefly the intestines.

Round worms vary from half an inch to three inches in length and are cylindrical in shape tapering at both ends. When numerous these worms may seriously interfere with the digestion and cause lack of proper nutrition. In some cases persistent diarrhœa has resulted and they have been known wholly to obstruct the intestinal passage. Reproduction takes place by the production of a large number of eggs in the bowels of infected stock. These eggs pass out with the droppings and under certain conditions may contaminate the food or be deposited in the water. Under favourable conditions the eggs of these worms will survive for a long period in the soil. Infection takes place when these eggs are swallowed by healthy stock either with water or food or when infected intermediate hosts such as flies, earth worms and termites are consumed. The development of adult worms from newly hatched larva after entering the alimentary-canal takes approximately three or four weeks.

Treatment.—There are several useful remedies for the eradication of these parasites given in the form of pills or mixed with mash after withholding food for twelve hours before treatment. The individual treatment of birds will be amply repaid.

(*a*) Chenopodium oil should be administered in a dough or bread pill at the rate of 2 drops of oil to one pound live weight of the bird, followed the next day by Epsom Salts 1 oz. to one gallon of drinking water to the flock, or one teaspoonful of oil of Chenopodium in wet mash for 12 birds, followed by Epsom Salts.

(*b*) Ten drops of spirit of turpentine to adult birds in a dough pill or in a dessertspoonful of salad or sweet oil on an empty crop followed by Epsom Salts as in (*a*) can be recommended. Liquid remedies can be safely administered to individual birds by means of a rubber tube and small funnel, the tube inserted through the mouth into the crop.

(*c*) Take 1½ lbs. of finely chopped Rhodesian tobacco stems or 1 lb. tobacco, if nicotine content is 5 per cent., soak in hot water for two hours and mix with 8 lbs. of mash. This is sufficient for 100 birds.

Administer twice at intervals of 3 days which is usually sufficient to free badly infested cases.

Feed this mixture in the early morning on an empty crop, withhold drinking water, then after two hours give water containing Epsom Salts (1 oz. to 1 gallon of drinking water). Feed as usual the next morning.

In all cases for chicks the doses should be reduced in proportion to age.

It is generally advisable to give the stock a change of ground after treatment in order thoroughly to free the runs and houses in which the fowls had been infested.

(2) **Tape Worms.**—These vary in length and breadth, they are flat and segmented the full length. Tape worms are found chiefly in the intestines and vary in size up to 4 inches. Numerous different kinds have been reported as affecting poultry, but all of them attach themselves to the inner lining of the bowels with their bodies suspended. They absorb the nourishment of affected birds, thus causing malnutrition. The posterior or ripe segments containing a large number of eggs are voided in the droppings and are consumed by an intermediate host such as flies and earth worms. In these hosts small embryos hatch out from the eggs. The host containing the embryo is swallowed by a fowl where the live larva or young worm is liberated and it attaches itself to the wall of the intestines and soon develops into a mature tape worm. The general remarks on round worms apply generally to tape worms. Turkeys are highly susceptible.

Birds so infested look unthrifty with ragged appearance and ravenous appetite, derangement of the digestion becomes evident by the passing of unabsorbed food, stunted growth in young stock, loss of egg production in the laying flock and often resulting in the death of infested birds.

Treatment.—(*a*) Give 10 drops of turpentine in a teaspoonful of oil, followed by Epsôm Salts in drinking water 3 hours later, or mix a teaspoonful of salts dissolved in warm water with 1 oz. of mash for individual dosing.

(*b*) Thymol.—In this treatment the birds should be starved and the drug given well mixed in wet mash. The

thymol is dissolved in ether at the rate of 1 oz. thymol in 2 ozs. ether, and this amount should be enough for a flock of 240 birds. Epsom Salts should be given after this treatment.

External Parasites.—The parasites of birds known as external parasites may be conveniently classified into the following groups, namely, ticks, mites, lice and fleas. There are those that live in the poultry houses, roosts and nest boxes, such as ticks, some mites and fleas, and those which pass their whole existence on the bodies of birds, such as lice, living on the feathers and scales of the skin. The effect of external parasites upon adult stock, although detrimental, is not as severe as in the case of young stock.

Turkeys, pigeons and canaries are all subject to infestation by lice peculiar to themselves and all of which can be controlled by reasonable care and attention. Among the precautions to be adopted for the elimination of poultry parasites it should be emphasised that care is necessary to avoid transmitting them to clean poultry yards by the introduction of new stock or crates or appliances that carry infection.

Fowl Tick (*Argus persicus*).—This tick, erroneously referred to as the "tampan," is undoubtedly the worst of the external parasites the poultry farmer has to guard against and is probably accountable for greater mortality in some districts and loss to the industry than any other insect vermin. The fowl tick is unfortunately widely distributed throughout South Africa and is to be found in other warm countries. It is often common in poultry houses and under the rough bark of trees where poultry roost at night. It essentially attacks fowls, but will make raids on ducks, geese, turkeys and pigeons under favourable circumstances. It transmits a disease called *Spirochætosis*, and which often proves fatal to poultry.

Method of Detection. Poultry farmers are sometimes quite unaware that fowl ticks are present until they become numerous. The fowls as they are attacked by this pest show the following symptoms:—Anæmia, with pale face and comb; they are listless with drooping wings and diarrhœa, the flock lays few or no eggs, some birds become semi-paralysed, usually lying on one side kicking their outstreched legs, they

may also sicken rapidly and die. Some flocks seem to become immune to this pest, and although surviving, the appearance of the stock is generally unthrifty and definitely unprofitable.

On examining the premises small dark specks resembling ink blots may be detected surrounding cracks or crevices in the woodwork, iron and brickwork of the houses and in the perches and nest boxes, in which case the presence of fowl ticks is practically certain. Take the blade of a knife or similar instrument, insert into cracks or any crevices in the vicinity of the perches, and if on removal blood is found on the blade a more detailed examination may definitely reveal the presence of fowls ticks. They feed only at night, taking refuge during the day, thus resembling the common bed bug, but they may be observed after dark moving about on the walls of the house and perches or feeding attached to the feet and body of the birds. It is usual in tick infested premises to find the larva attached to the fowls under the wings.

Appearance and Life Cycle.—The adult fowl tick is oval in shape, slightly tapering towards the head, and flattish, with eight legs. The body extends over the head forming the shield. The colour when disengorged is light brown, withered in appearance, and when engorged they become darker, almost dark slate in colour, with indentations on the back or dorsal surface.

The female lays a large number of eggs as a rule, usually several a minute, in protected places, such as in cracks or crevices inside poultry houses in close proximity to the roosts. The incubation period is about three weeks, and the larvæ at first are transparent to the naked eye, round in shape and having six legs. They immediately search for a host, then become translucent and later as they become fully engorged the colour changes to dark grey, and in size and shape they resemble the head of a pin. The larval stage is spent attached to the fowl day and night, usually under the wings, for approximately ten days, engorging themselves. It is during this period they are transported from one locality to another and thus become widely spread throughout the country. As they become fully engorged they leave their host and assume the habits of adult ticks by hiding during the day and coming

out to feed only at night. They pass through the nymphal stages during which time the number of their legs is increased to eight and finally develop into adult ticks. The life cycle from the egg stage covers a period of several months.

The fowl tick can exist for long periods without food and even change of air; they have been known to live for two or three years apparently without a host. It is due to this resistance that birds when placed in poultry houses that were known to be infested but which had been empty for two or three years, are immediately attacked after dark and within a day or two, much to the surprise of the owner, they obviously sicken followed by mortality.

It is imperative that poultry farmers should exercise reasonable vigilance at all times so to avoid introducing this pest to the farms. They may be transported by tick infested fowls and crates removed from premises that are infested, also by the poultry of native hawkers.

Elimination of Fowl Ticks.—It behoves every farmer to guard against the introduction of the fowl tick by all possible means within his power, and if present to act promptly with a view to its destruction. As long as fowl ticks are present it is unsafe to keep poultry on the premises, because the financial loss is often excessive; certainly it means the difference between profit and loss.

It is advisable to scrutinise all new birds on arrival at the farm, and in the event of any doubt to dip individual birds and isolate for ten days in temporary quarters which can be burned, before placing them in their permanent houses, thus definitely avoiding the introduction of the fowl tick to clean quarters.

The houses should be constructed with a view to easily controlling insect vermin, smooth walls internally should be provided and all fittings and utensils to be detachable. An annual application of some wood preservative and insecticide to all woodwork. Alternatively the perches and other movables could be immersed for several days in a cattle dipping tank for the destruction of insect vermin.

Where premises are infested perseverance and patience are first necessary to eradicate this pest. Tick infested houses that may not be of great value should be destroyed by burning, including all the fittings.

For brick houses and houses constructed of corrugated iron containing woodwork which are valuable, the use of a plumber's blow lamp is recommended. Direct the flame into all crevices and overlapping joints in addition to spraying with a strong disinfectant solution. Plaster all walls thoroughly and whitewash. After a thorough renovation as suggested, vermin proof perches might be considered, but it is advisable also to hang one or two pieces of plank on the wall in proximity to the perches. These serve as traps behind which these ticks will hide during the day when they can be conveniently collected and destroyed at regular intervals.

The elimination of the fowl tick depends largely upon the vigilance and thoroughness with which any measures for their destruction are carried out.

Treatment.—The treatment of affected birds consists of isolation in clean quarters after removing the attached larvæ by dipping. Feeding on bread soaked in milk or moist mash and giving a tonic (Easton's Syrup or Parish's Food) in the drinking water will restore to normal health individual birds not seriously affected.

Dipping is carried out by submerging the body and lower part of the neck of the bird in a solution of Jeyes or Kerol, 3 tablespoonsful to 4 gallons of warm water, saturating the feathers to the skin.

The Tampan (*Ornithodorus moubata*) although a tick, it does not resemble the fowl tick, being round and full. The colour is darker brown than the fowl tick and the dorsal surface contains several elongated indentations radiating towards the sides which are characteristic of the tampan. It is not nearly so widely distributed as the fowl tick in South Africa.

Red Mite.—This is generally known as the tropical Red Mite of poultry and is a serious pest throughout South Africa. As the name implies this parasite is very small, almost trans-

parent after hatching, but changing to bright red in colour as it becomes engorged with blood, when they can be easily observed, afterwards changing to brown as the adult stage is reached.

These mites often occur in countless numbers and they are blood suckers. They frequent poultry houses and pigeon lofts, attacking their host at night, and are usually active during the warm weather. Their presence may first be suspected by general unthriftiness and restlessness of the flock. Young pigeons may be found dead in the nest or chickens under broody hens without any apparent reason; it is not unusual to observe pigeons stamping their feet and generally restless after alighting on their loft or as they stand in close proximity to their nests. Their presence is often detected by what appears to be red lines emerging from cracks or on the hoppers, roosts and other parts of the poultry houses. These lines on closer examination reveal thousands of these moving mites forming an unbroken red line, or they may be seen swarming as small dark moving bodies in nest boxes, on the perches and other fittings in the houses. They will hide in clusters under the perches and undisturbed boxes, also is overlapping wood, in crevices and in any loose material lying about the houses.

These mites sap the vitality of the stock by swarming on them to feed, causing considerable irritation and restlessness at night on the roost, so much so that poultry will abandon infested houses. It is often difficult to make poultry occupy badly infested houses, and they will rather resort to trees or fencing posts to roost. Sitting hens will leave their nests pale and anæmic and pigeons will desert their loft.

It is a persistent pest in neglected poultry coops and houses and one of the most irritating to both poultry and the attendant.

A general lack of tidiness and cleanliness in runs, houses and utensils, or otherwise negligence of the plant and loft, are favourable to their propagation.

Treatment.—A thorough renovation of the premises is required and a clean up generally, and all utensils, perches and nest boxes painted with solignum or carbolineum or

treated with boiling water containing antiseptic would be effective. Cleanliness and ordinary care will serve to eliminate this pest. Sitting hens and pigeons should be dusted with insect powder, as well as the nesting material, before settling them down. Repeat also after hatching. In the case of pigeon lofts, the nesting apartments or racks should be thoroughly cleansed on removal of the squabs.

Lice.—Birds that are infested with lice are said to be lousy. The louse family consists of many species, all of which spend their existence on the bodies of birds, and only leave accidentally. They can generally be controlled by the birds themselves under natural conditions, but under certain circumstances individual birds may become overrun with lice or lousy if not given attention. The effect of lice when numerous is quite noticeable even in the case of healthy vigorous birds.

According to their habits they may be divided into three groups.

(1) Head lice which is usually found on the head and neck of chickens and adult fowls attaching itself to the crown and base of the head, grey in colour, is not very common in Rhodesia. In some countries it is responsible for much mortality. The application of mercurial ointment to affected parts is recommended for the destruction of this louse.

(2) Body lice infest the bodies of birds. They are usually found at the base of the neck, under the wings and vent feathers. They vary in size, are generally light or straw-coloured and are probably the most common of all lice. On turning up the feathers they will be observed moving quickly over the skin of the bird or at the base of the feathers, so quickly they cannot easily be caught These lice sometimes becomes attached to the hands when handling birds and are found later crawling up the arms and neck. Their eggs are deposited in clusters attached to the base of the feathers. Poultry are never actually free of this parasite, but they are probably the least harmful, except when very numerous, as they can be kept under control by their host. The natural measures for all birds to free themselves and control this pest is by dust bathing or wallowing in loose moist earth. A site should be provided in the pens in the shade of trees for this purpose, keeping the earth moist and loose. It is not

necessary to incorporate with the soil ashes, sulphur or other preparations. The stock prefer clean moist earth, but under circumstances where they cannot have access to this, for example when isolated in cages, the most suitable precaution is to insect-powder the birds, as lice multiply at an alarming rate and have a depressing effect on the stock. In bad cases the feathers containing clusters of eggs or are matted should be removed by cutting them off. The application of insect powder such as sodium fluoride well dusted under the feathers twice at intervals of 10 days should serve to eradicate this louse.

(3) Depluming Mite or Lice live chiefly upon the feathers of birds and is a biting louse, their body is long with a large head. There are several kinds, which attack the feathers of various parts of the body, destroying the floss and other fine parts, thus disfiguring the feathers and giving the infested birds a ragged or worn appearance. These lice are fairly small, and grey or dark in colour. Insect powder is generally sufficient to eliminate them, applied every three or four days until the lice have disappeared, otherwise dipping individual birds will be necessary. Two tablespoonsful of Kerol or Jeyes fluid to 4 gallons of water is sufficient for this purpose.

Leg Scabies Mite causes scaly legs and is widely distributed in South Africa and elsewhere. It is prevalent mostly in yards were supervision is not strictly observed. It confines itself chiefly to the shanks of birds, burrowing under the scales, causing irritation which results in the secretion of a fluid; this dries forming a light coloured crust first in patches, but when neglected will thickly cover the whole surface of the shanks, disfiguring them and causing intense irritation of the legs and feet; so much so that affected birds may be observed pecking at the scales for relief, incidentally the mites being protected by the crusts, continue their torture incessantly and finally the affected birds are unable to walk without difficulty. From this it will be fully realised that such a condition undermines the health and vigour of birds which is quite marked, resulting in unproductiveness and financial loss. The removal of pieces of scab by the birds may release the parasites, which will survive on perches and nesting material for several weeks, during which time they spread and affect the birds.

Like other parasites this mite is transferred from one bird to another by contact and chiefly from infested perches and utensils, thus for preventing the spread of this parasite prompt measures are necessary with a view to its eradication. The infested stock and the roosts must receive attention. Old stock that are badly affected should be destroyed. The perches and other utensils should receive a dressing of solignum, carbolineum or other insecticide, burn all rubbish.

Treatment.—The legs and feet should be thoroughly saturated with warm water containing soft soap and with the fingers or with the aid of a nail brush carefully remove the loose scales without causing exposure of raw surfaces and bleeding. Dry with a cloth and apply thickly an ointment prepared as follows:—Take lard or tallow 1 lb. rendered over a flame and mixed with a tablespoonful of Kerol or Jeyes and allowed to cool. After two or three days repeat the process with the soap emulsion and ointment. Continue this treatment until the shanks have healed or are restored to normal.

The Flea (*Echidnophaga gallinaceus*).—Fleas differ from other external parasites of birds as they are capable of jumping. They are shiny and black or dark brown in colour. The conditions required for propagation are undisturbed corners, in cracks in the floors, under boxes and other places when dust and filth accumulates in the runs and houses. It may be stated that it is almost impossible to keep poultry houses with loose earth floors or untidy runs free from this pest, except by constantly spraying at considerable cost and annoyance.

They are blood sucking insects and will attack poultry during the day and night. The "Sand Flea," or "Stick Fast Flea," spends most of its existence attached to the skin of birds on the head and neck. It firmly attaches itself to the skin of its host, burying its head firmly into the outer layers of the skin, where it remains feeding, causing irritation and inflammation. They confine themselves to the vicinity of infested houses, generally noticeable for the first time on the clothes of the attendant or attached to the head parts of the fowl.

They lay their eggs in favourable localities inside the houses or sheltered positions or multiply rapidly where there is an accumulation of dirt. They hatch within a week and the larva thrive in these surroundings, undergoing various stages before reaching the adult stage in two or three weeks.

Prevention.—These parasites, as with all poultry parasites, are capable of being eliminated by reasonable precautions such as maintaining clean healthy conditions for the stock to live in, as would be necessary for the well being of all other classes of animals. The first necessity suggested for the control and elimination of fleas and the most economical is to provide an impervious floor in all poultry houses. The floor of the house should consist of a single layer of bricks or rubble washed over with cement mortar to make it impervious. If at a later date cracks develop, these should be filled in with cement. Appliances such as hoppers and nest boxes should not be left lying about indefinitely in the runs or houses, they should be elevated and fixed a short distance off the floor, thus the whole floor space becomes accessible for the birds to scratch in the litter provided for this purpose. The dropping boards should contain a thin layer of earth which should be replaced at weekly intervals. These simple precautions minimise any possibility of fleas multiplying and becoming established.

Treatment.—It is necessary to emphasise in reference to the treatment of infested birds, that unless the surrounding conditions are favourable for the eradication of fleas, such as described above, repeated attention, almost indefinitely, will be necessary in order to render relief to the stock.

In houses where fleas have become established it is necessary to burn all the litter, clean the houses and runs thoroughly, and spray with a strong solution of carbolic disinfectant. Smear carbolised vaseline, or vaseline containing a little sulphur, to the parts where fleas have attached themselves. Dust the whole body of the birds well under the feathers with sodium fluoride. Unless fleas are eradicated from the poultry house and surroundings the birds will in a short time again become infested, when a repetition of this treatment will be necessary.

Southern Rhodesia Weather Bureau.

OCTOBER, 1936.

Pressure.—Barometric pressure was generally slightly below normal.

Temperature.—Mean monthly temperatures over the greater part of the country were also slightly below normal.

Rainfall.—Thunderstorms occurred from the 4th to the 6th, a few more on the 9th and 10th, and from the 13th onwards showers occurred every day. This is rather unusual for October and all areas were above normal at the end of the month, nearly double the average being recorded over the whole country.

OCTOBER, 1936.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen °F.								Rel. Hum.	Dew Point	Cloud Amt	Precipitation.			Altitude (Feet)
			Absolute.		Mean.												
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal	No. of Days	
Angus Ranch... ...	...	...	102	54	86.8	63.7	75.3	76.9	73.5	64.1	60	59	...	0.60	0.86	5	...
Beitbridge...	965.1	...	102	55	87.1	65.1	76.1	...	73 3	63.3	59	57	5.5	1.05	1.15	5	1,500
Bindura...	892.3	...	93	56	85.5	63.1	74.3	...	72.2	61.5	55	55	3.3	1.74	0 60	5	3,700
Bulawayo	869 8	870.3	94	51	84.9	58.6	71.8	72.3	68.8	58.7	54	51	4.5	3.87	0.82	10	4,393
Chipinga	893.7	...	91	48	78.1	57.5	67.8	...	67.7	60.8	71	57	4 7	1.91	1.48	9	3,685
Enkeldoorn...	858.3	...	91	47	82.9	57.1	70.0	71.3	69.9	58.4	52	50	2.4	1.32	1.27	5	4,788
Fort Victoria	896.3	896.3	95	48	84.1	59.3	71.7	71.1	70.5	61 0	61	55	...	1.31	0.95	6	3,571
Gwaai Siding	903.6	...	100	52	94.3	61.4	77.9	...	75 8	...	...	...	2 6	0.90	0 69	3	3,278
Gwanda...	906.8	...	97	53	84.5	61.3	72.9	...	71.1	60.9	59	54	5.4	2.19	0 93	6	3,233
Gwelo	862.8	...	92	51	83.8	57.9	70.9	72.5	68.4	58.6	58	52	3.4	1.76	0.74	7	4,629
Hartley...	885.7	...	95	52	86.8	60.6	73.7	75.0	73.9	61.3	49	53	3.1	1.03	1.11	7	3,879
Inyanga...	838.0	...	87	43	78.9	53.2	66.0	...	69.3	57.7	51	49	2.2	3.89	1.17	9	5,503
Marandellas	838.4	...	86	47	79.1	56.2	67.6	...	67.9	57.8	55	50	2.6	0.71	1.36	7	5,453
Miami	879.1	...	92	56	84.5	61.6	73.1	...	71 9	60.5	53	53	3.5	0.56	0.21	4	4,090
Mount Darwin ...	908.4	...	96	51	88.1	62.1	75.1	..	74.2	63.5	56	57	3.8	1.09	0.42	2	3,179
Mount Nuza	803.0	...	76	45	65.7	51.0	58.4	...	58.7	53.1	72	49	6.5	7.49	1.11	12	6,668
Mtoko	878.1	...	91	54	82.3	61.5	71.9	...	71.7	61 1	55	54	3.6	2.61	0.77	5	4,141
New Year's Gift...	...	...	98	49	85.0	59.4	72.2	...	70.6	62 8	65	58	...	0 97	1.17	7	2,690
Nuanetsi	962.4	...	102	48	87.4	61.9	74.7	...	72.8	64 4	66	60	5 8	1.32	0.65	5	1,581
Plumtree	864.4	...	92	52	84.9	60.0	72.5	...	70.7	59.0	51	52	4.8	1.33	0.74	7	4,549
Que Que	882.3	...	95	53	86.6	60.2	73.4	...	71.1	60.6	55	54	3.3	1.58	0.91	10	3,999
Rusape	862.9	...	92	45	81.9	57.0	69.5	...	69.9	59.0	54	51	2.9	1.71	0 71	6	4,648
Salisbury	856.9	857.1	89	51	82.1	58.0	70.1	71.0	69.8	59.1	52	51	3.3	3.43	1.11	9	4,831
Shabani...	910.6	...	98	53	84.8	61.3	73.1	...	70.8	61 8	63	56	4.9	1.18	0.87	7	3,131
Sinoia	888.7	...	94	50	87.0	60.1	73.5	...	74.2	62.2	51	55	3.2	2.00	0.80	7	3,795
Sipolilo	885.7	...	92	53	85.1	63.1	74 1	...	74.5	61.8	50	53	2.6	1.70	0.54	3	3,876
Stapleford	843.0	...	83	36	71.9	51.7	61.8	...	64.3	57.8	71	53	4.7	4.12	2.12	11	5,304
Umtali...	893.7	894.1	96	49	82.8	58.9	70.9	70.9	69.8	61.3	64	56	4.8	0.43	1.13	8	3,672
Victoria Falls... ...	911.2	...	102	...	96.7	...	...	...	80.4	65.4	45	57	2.3	0.06	0.64	2	3,009
Wankie	926.0	...	103	65	97.8	72.6	85.2	..	81.4	67.5	49	60	2.4	0.99	0 30	6	2,567

Rainfall in October, 1936, in Hundredths of an Inch. Telegraphic Reports.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	Normal
...	...	.		...	...	...	..	...	...	...	...	...	3	...	6	15	14	...	...	5	15	5	79	31	...	...	10	17	32	...	232	85
...	..	...	1	1	...	...	...	...	...	...	...	...	8	...	...	4	40	...	...	...	...	...	2	28	2	...	4	19	18	1	128	88
...	...	...	...	4	2	...	...	8	...	...	...	...	...	...	...	...	21	.	...	...	...	...	...	22	18	11	...	64	9	12	171	140
...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	14	6	38	1	...	...	...	1	12	6	12	...	16	19	33	...	159	96
...	...	...	...	...	...	...	...	...	...	...	...	3	8	...	1	7	...		1	..	7	11	15	10	...	4	...	...	12	...	79	56
. .	...	...	...	1	11	...	...	...	30	..	...	...	6	6	15	7	6	...	...		...	12	...	...	40	..	..	1	7	4	146	104
...	...	...	...	7	3	..	...	3	5	...	...	...	...	49	1	24	2	...	9		...	...	...	24	3	15	...	2	7	22	176	119
..	...	..	...	22	46	.	...	...	...	...	...	...	...	34	...	8	4	...	...	..	...	4	...	18	2	...	...	2	8	22	170	93
...	...	...	...	...	10	...	...	...	...	...	...	...	...	39	10	13	65	...	...	...	...	...	...	7	1	...	...	3	1	33	182	61
...	...	...	...	...	...	...	...	1	...	...	...	...	...	125	...	...	..	...	..	...	...	...	...	3	...	...	..	...	53	3	185	59
...	...	...	...	2	4	...	...	...	4	...	...	1	4	18	6	10	20	..	1	1	4	4	18	16	7	2	4	8	17	8	159	83

Southern Rhodesia Veterinary Report.

SEPTEMBER, 1936.

No fresh outbreaks of scheduled diseases during the month.

MALLEIN TEST.

Six horses, 24 mules and 9 donkeys were tested. No reaction.

TUBERCULIN TEST.

Forty-two bulls and 29 cows with negative results. Four animals of the Harleigh herd were re-tested and gave no reaction.

IMPORTATIONS.

From Union of South Africa.—26 cows, 40 bulls, 6 horses, 24 mules, 992 sheep and one goat.

From Bechuanaland Protectorate.—558 sheep.

EXPORTATIONS.

To Kenya.—5 bulls and 4 cows.

To Northern Rhodesia.—9 donkeys.

EXPORTATIONS.—MISCELLANEOUS.

To United Kingdom in Cold Storage.—Chilled beef quarters, 6,743; frozen boned beef quarters, 6,527; frozen beef quarters, 10,467; frozen boned veal sides, 577; kidneys, 5,911 lbs.; tails, 3,530 lbs.; skirts, 6,268 lbs.; shanks, 18,407 lbs.; tongues, 32,954 lbs.; livers, 20,958 lbs.

Meat Products.—From Liebig's Factory: Corned beef, 131,100 lbs.; meat extract, 21,983 lbs.; beef powder, 98,982 lbs.; beef fat, 2,900 lbs.; meat meal, 34,000 lbs.; tongues, 3,600 lbs.

G. C. HOOPER SHARPE,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA.

Locust Invasion, 1932-36.

Monthly Report No. 47, October, 1936.

The number of swarms of the Red Locust (*Nomadacris septemfasciata*, Serv.) reported to the Department has gradually diminished during the month and the great majority of reports have referred to the eastern and southern districts of the Colony.

Whilst a general movement to south and east has not been clearly apparent from the direction of flight indicated in reports, it would appear that the northern districts of the Colony have been gradually evacuated.

The most hopeful feature of the position is that no pre-breeding invasion by swarms from the north of the Zambesi has at yet occurred. In October, 1934, the Colony sustained a tremendous invasion from the north, and even in 1935 swarms were more generally distributed in the Colony towards the end of October than they are at present.

The prospects for the coming hopper season, therefore, appear to have improved, but as the breeding season has tended to become later year by year during the present swarm cycle, it would be premature to take too optimistic a view of the position.

Some damage to crops and plantations has been reported from the eastern border. No evidence of disease or parasitation has been recorded, and bird enemies have apparently not been active.

RUPERT W. JACK,
Chief Entomologist.

Farming Calendar.

DECEMBER.

BEE-KEEPING.

With a normal season the first or main honey-flow of the year should now be over and the honey ready to be robbed. Before doing this, see that all or the main portion of the frames are capped and sealed, otherwise there will be trouble later on by fermentation. There is nothing on the market to equal the Porter bee-escape board to clear out the bees from the crate, but be sure and see that the board in question is placed the right side up under the crate; failure to do this (and in the hurry of the minute it can easily be so done) will result in the probable suffocation of the bees and the loss of the honey, to say nothing of the chances of robbing from any close-by hives. Replace the empty combs and frames as soon as possible on the hives, to be cleaned up and mended where necessary, and for future storage of more honey. During the very hot spells watch the hives and provide extra ventilation, by inserting small metal wedges between the crates, just wide enough to allow air in, but not a bee under any consideration. Keep all water tins under the hive-stand legs full of water, and see that water is available for the worker bee, which drinks a good deal. When extracting honey, do so in a bee-tight room or verandah, otherwise the operator may have a lot of trouble from other colonies, which quickly find where honey is. Always have one or more crates of shallow frames ready with foundation fixed to place on hives as the season may warrant; such will mean always something for the bees to work at, and during the last flow they may be invaluable to store any such catch crop of nectar, as from tobacco, etc., when the natural flora is finished.

CITRUS FRUITS.

This is a good month to plant citrus trees in their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain or watering. If good rains have fallen, disc the grove in two directions, then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold.

Continue planting maize, cotton, beans and ground-nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, oats, Sunn hemp should be planted after the other crops are in. Ensilage crops may be sown at the end of the month. When harrowing maize after planting, this work

should be done in the heat of the day when the young plants are flaccid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc-harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats for smut before sowing. Use one pint of formalin to 25 gallons of water and steep the bag of seed for ten minutes. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken. as circumstances permit, during December, January and early February, and again ploughed in from May to July. If they carry a heavy crop of grass it should be cut or burnt to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Do not fail to have in a few acres of this valuable crop.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size.

ENTOMOLOGICAL.

Maize.—The first half of this month appears to be the best period during which to plant maize for the avoidance of stalk-borer attack—at least in the Salisbury district. Hoe out and remove volunteer maize plants before the new crop is up, as they are liable to be infested with borer, which tends to spread to surrounding plants. Red soils may be baited with chopped Napier fodder or other suitable green stuff dipped in arsenate of soda 1 lb., cheapest sugar 8 lbs. or molasses 1 gallon, water 10 gallons, to destroy surface beetles, snout beetles and other insects which may affect the primary stand.

Tobacco.—The enemies of this crop are in general most active during December, whilst the crop is still in the early stages of growth.

For information regarding tobacco pests, see "Rhodesia Agricultural Journal," January, 1928, or Bulletin No. 665.

In general, poisoned baits may be used against surface beetles, grasshoppers, crickets and cutworms. Against surface beetles, arsenite of soda 1 lb. in 30 gallons of water used to moisten maize bran is a good bait. Against grasshoppers and crickets the addition of 8 lbs. sugar or 1 gallon molasses to each 1 lb. of arsenite of soda is recommended. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water against leaf-eating insects and as a protection against leaf miners and stem borers. Transplants may be dipped head downwards as far as the roots in the poison. Discard seedlings infested with stem borer and root gallworm.

Cutworms.—Keep ground around seed beds as free as possible from vegetation, to prevent female moths from laying eggs there. From the time the plants show foliage of the size of a sixpence they should be sprayed weekly with arsenate of lead (powder) 1 lb. to 30 gallons of water. This should prevent cutworms developing in the beds, as the young cutworms attack the leaves of the seedlings, and so ingest the poison.

House Flies.—With the coming of hot weather and the rains, house flies greatly increase, and should be kept out of dwelling houses by

mosquito netting, or poisoned in the following way:—Dissolve 1 lb. of sodium arsenite in 10 gallons of water, and add about 10 lbs. of cheap sugar (2 gallons of treacle) or other sweet substance. The mixture should be sprayed upon branches of shrubs or trees, which may be hung up in convenient places where flies congregate. These insects are attracted to the bait, and are easily poisoned.

Mosquitoes, Stable Flies.—Destroy breeding places around homestead. Poison or trap adults.

Potatoes.—Ladybirds and caterpillars may be injurious to the foliage, and on sandy soils blue blister beetles sometimes cause damage. Spray with arsenate of lead (powder) 1 lb. to 25 gallons of water.

Kitchen Garden.—Marrows, etc., are commonly attacked by leaf-eating beetles. Spray with arsenate of lead (powder- 1 lb. in 25 gallons water, plus 8 lbs. cheapest sugar or 1 gallon molasses. Dusting lightly with pure arsenate of lead powder should give protection. Young plants of the cabbage family may be dusted with pure arsenate of lead powder or with such powder mixed with up to six or eight parts of finely sifted, thoroughly slaked lime as a protection against leaf-eating insects.

Fruit Trees.—The regular collection and destruction of fruit beetles may be necessary. Choice varieties of peaches, etc., may be netted as a protection against pests.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of Cedrela toona seed may be made.

POULTRY.

The poultry keeper should take precautions whereby the wet weather will not affect his birds' health and their laying powers. All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs. Foodstuffs also must be kept absolutely dry.

Many birds will at present be moulting; these require special treatment to bring them through it quickly, and if possible keep them in lay during the period. A pamphlet on this can be obtained from the Poultry Officer,

Department of Agriculture. This lack of attention to the birds during the moult is one of the causes of the scarcity of eggs at this season. There is no need for it if poultry keepers would only look after their birds properly.

Those who intend disposing of their turkeys for killing at Christmas must avoid cooping them up, as is done when fattening fowls, for they immediately mope and go off their food. Give them free range, and in addition to their usual evening feed of maize, during the first week of December give one of wheat or maize in the morning. and during the second and third weeks three meals a day, each one containing, in addition to wheat or maize, some crushed monkey nuts or sunflower seeds. Plenty of thick milk and chopped-up onions or onion tops should also be given.

Those who go in for ducks should feed well and get as many to marketable size as possible by Christmas, when they usually fetch good prices. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, maize meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 pm., and the first meal is given at sunrise.

STOCK.

Cattle.—Feeding should be continued on the same lines as in November. Keep a close eye on any store bullocks that have been selected for fattening on grass.

Ranching cattle should not require any attention beyond dipping. Every effort should be made to have all the female stock in good condition for the breeding season.

Milch cows should be protected as much as possible from cold rains and hot sun. Yarding at night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf-pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks. Take out the rams at the end of the month.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertiliser to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VETERINARY.

Occasional cases of horse-sickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gall-sickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland the rainfall during this month varies from eight inches along the eastern border to six inches in the west. In Matabeleland it varies from five-and-a-half inches in the west to four-and-a-half inches in the south. Considerable divergencies from these normals may occur in individual seasons, but on the whole this month is the most regular in its behaviour. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of very heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight, or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

JANUARY.

BEE-KEEPING.

This month is a slack one for actual hive work. Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped. In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions against the depredations of white and other ants should also be watched daily. Where possible. examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months. Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once. such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed. Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done. push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

ENTOMOLOGICAL.

Maize.—Late planted maize, particularly crops planted after the New Year are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol use at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanimycus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant. or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses 1½ gallons, or cheapest sugar lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to

employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Warm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal*, October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month. Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal*, August, 1933.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead (powder), at the rate of 1 lb. in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight. To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil.

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928. The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.—Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire. Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow. The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds.—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields. Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead 1 lb. in 30 gallons of water.

Wire Worms (*Trachynotus* spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning wih a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.)—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in

the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leaf-eating beetle (*Ootheca mutablis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas. Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies which "sting" fruit:—Arsenate of lead (powder), 1½ ozs.; molasses, ½ gallon, or cheapest sugar, 2½ lbs.; water. 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump.

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed. Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead. House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon a they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground. thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb.); also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran and give about one desert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range.

Ducks must be treated in almost exactly the reverse manner to what turkeys are. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard. mealie meal, meat meal and milk, as much as they will eat three times a day, *i.e.*, they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Put the bulls into the herd now to secure spring calves. The bulls should be in good condition at the commencement of the service season and their condition should be maintained while they are working. This season calves should be looking well by this time and care must be taken not to over-milk the cows in consequence. Cows rearing calves should not be milked more than once a day. Hand-reared calves should be kept in dry, clean quarters. In the warmer weather they often do better if they are kept indoors until they are three or four months of age. Bullocks which are being fattened on grass should receive a concentrate ration from now onwards. During this month a protein concentrate should usually be added to the milch cows' ration.

Sheep.—Keep the sleeping quarters as dry as possible. Keep the sheep away from vleis and "rotate" the grazing as much as possible. Sheep are liable to suffer severely from internal parasites from now onwards.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, *i.e.*, a cow producing three gallons of milk should receive 6 to 7 lbs. of

concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.